

THE ANALYSIS OF THE LINK BETWEEN CAPITAL FLOWS AND
MACROECONOMIC-FINANCIAL-SPATIAL INCOME DISTRIBUTION
INDICATORS: COMBINING FINANCIAL CGE AND PERCEPTION MODELS

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by

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This dissertation analyzes the intricate yet critical link between macroeconomic, financial, and social variables, including spatial income distribution, and how the income inequalities are affected by certain policies and external shocks. The first chapter shows the importance of including the financial sector in today's economic and policy analyses by demonstrating the difference between the computable general equilibrium (CGE) model and its extended version that incorporates financial sector, the financial computable general equilibrium (FCGE) model. The updated FCGE model in the second chapter is then employed to analyze the increased foreign capital inflows intermediated through the banking sector, reflecting the current phenomenon in Asian emerging countries. Based on the results of simulations, some policies are proposed. The upsides and the downsides of each are analyzed in great detail in Chapter 3 by using the analytic hierarchy process (AHP) and analytic network process (ANP).

Chapter 1 analyzes the difference between CGE and FCGE models, from which we conclude that serious erroneous implications and inaccuracies arise from CGE's neglect of the financial sector's role. By simulating both models in scenarios of

increased government spending, depending on whether government spending is financed through taxes or government bonds, the results clearly show how the negative impacts on the social indicators generated by the CGE model can be underestimated. Examples of this underestimation are the macroeconomic impact of increased government spending and the social impact of financing the spending through taxes. I also found that the CGE results underestimated these negative impacts of increased capital flows in the same fashion.

The analysis in Chapter 2 highlights the negative impact of risky financial investment behaviors of the banking sector resulting from the increased capital inflow on the economy. This chapter, in particular, stresses that one must consider not only its macroeconomic impact but also its negative repercussions on spatial income distribution and poverty conditions. Chapter 2 also shows that the risks of a boom and bust cycle where the bank-led flows are reversed from inflows to outflows and the impact of the change in banks' behavior from risk-taking to risk-averse. While risk-averse behavior can produce more favorable macroeconomic and social outcomes, there is no reason to expect that such behavior will be maintained by banks when capital inflows increase. It is therefore suggested that some measures should be taken to limit the size of bank-led flows.

Chapter 3 focuses on the policy analysis based on the results of model simulations in Chapter 2. From three alternative policies – i.e., aggressive monetary policy, assigning a levy on non-core liabilities, and encouraging capital outflows – it is suggested that policymakers seriously consider imposing some sort of levy on bank-

led flows. Such a conclusion is derived after taking into account the benefits, opportunities, costs, and risks of bank-led inflow based on the priority ranking of the policies, the components (criteria) and strategic goals that include macroeconomic, financial and social considerations. A series of sensitivity analyses confirm that the results are robust. In the context of the present situation in many countries, the suggested policy is part of what is known as macroprudential policy.

Finally, directions for future research are suggested. The analysis in Chapter 2 could be extended upon by incorporating more financial instruments and other social indicators, or by improving the accuracy of the parameters involved in the model. For example, rather than calibrating all of the parameters, one could estimate some of the parameters by utilizing econometric equations with time series data. Furthermore, for Chapter 3, one could conduct the analysis by using direct interviewing with the same approach and model. Respondents could include experts or policymakers who would express their perceptions regarding the relations among variables in the model. In this way, the resulting priority ranking from the model simulation can be compared with, or tested against, policymakers' perceptions, from which new insights may emerge.

BIOGRAPHICAL SKETCH

Hee Hwa Min was born on March 13, 1984 in Seoul, South Korea. After graduating Hyesung Girl's High School, in 2003, she entered Sungshin Women's University in Seoul, South Korea, to study Geography. In 2005, she served as student president for the Department of Geography in Sungshin Women's University, and received recognition for being the top ranked student in her class. In 2008, she earned her Bachelor's Degree and moved to Ithaca, NY in U.S.A. to pursue a Doctorate in Regional Science at Cornell University, Ithaca, New York in U.S.A.. She received a Master of Science in Regional Science in 2011 at Cornell University, Ithaca, New York in U.S.A. From 2011 – 2014, she continued her graduate study in Regional Science and expects to receive Ph.D. in Regional Science in January 2014. Upon completion of her Doctor of Philosophy degree, she joined Cornell Economic Impact Studies as a research assistant from 2013 to 2014.

While studying at Cornell, she met her husband, Kiwoong Lee, who is a J.D. student at the Cornell University Law School.

To my dad, my mom, and my husband.
그리고 하나님께 이 논문을 바칩니다.

“For from him and through him and to him are all things. To him be the glory forever!

Amen”- Rome 11:36

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CHAPTER 1

**THE RISK OF NEGLECTING THE FINANCIAL SECTOR:
THE CGE AND FCGE MODELS IN COMPARISON**

1.1. Introduction

Whether we like it or not, a somewhat disturbing development has occurred in many countries around the world. While conceptually the role and development of the financial sector is meant to support the real sector of the economy, this has not been the case over the last several decades. The growth of the financial sector has far exceeded that of real sector. Several studies have sought to explain the reason behind such a trend where the key culprit is the combination of financial sector innovation with progress in financial technology and minimal regulation. This has happened in developed and developing countries alike, and emerging market economies are no exception. In fact, most financial crises in emerging market economies can be explained in one way or another by such a phenomenon. Financial globalization and deregulation further exacerbate the situation because there are no longer restrictions on the flows of capital. At any rate, the dynamics of economic growth and development in most emerging market economies has been significantly influenced by development in the financial sector.

It is well-known that the current global financial crisis has had negative repercussions on the advanced economies including the US economy. These repercussions, in turn, have also impacted many developing and emerging market economies worldwide. With globalization, where the financial sector has played an

increasingly important (if not the most important), the impact that started from the US financial market has flowed into the economies of other countries through their financial systems. These repercussions affect the real sector in various ways, such as high unemployment and a decrease in income, consumption and production as well as increased vulnerability of the financial sector. Any analysis omitting this sector, therefore, is bound to be misleading.

This chapter focuses on the comparison between the CGE and FCGE models. In particular, we impose some shocks on the two models and evaluate the transmission mechanism in each, upon which basis we then analyze the different results produced by the two models and argue that neglecting the role of financial sector in CGE can produce erroneous results. While the final results are important to compare, the transmission mechanism is even more important to understand because it sheds some light on the question of where and in which parts the government should intervene with its policy if a particular result is targeted. The CGE model itself is comprehensive enough to show such a transmission mechanism, and it allows us to implement a more accurate method when we wish to analyze the impact of a particular policy. Without this model, we are forced to analyze the policy impact by only examining a set of variables prior to the policy shock and then the same variables afterwards. This ‘before and after’ approach is flawed because it neglects the role of other things which occur simultaneously with the shock. A more accurate approach would be an approach that examines the situation ‘with and without’ policy shock. This can be done only if we have a model representing the economic system being analyzed. The CGE we are using in this chapter is an example of such models. In other words, the model is like a

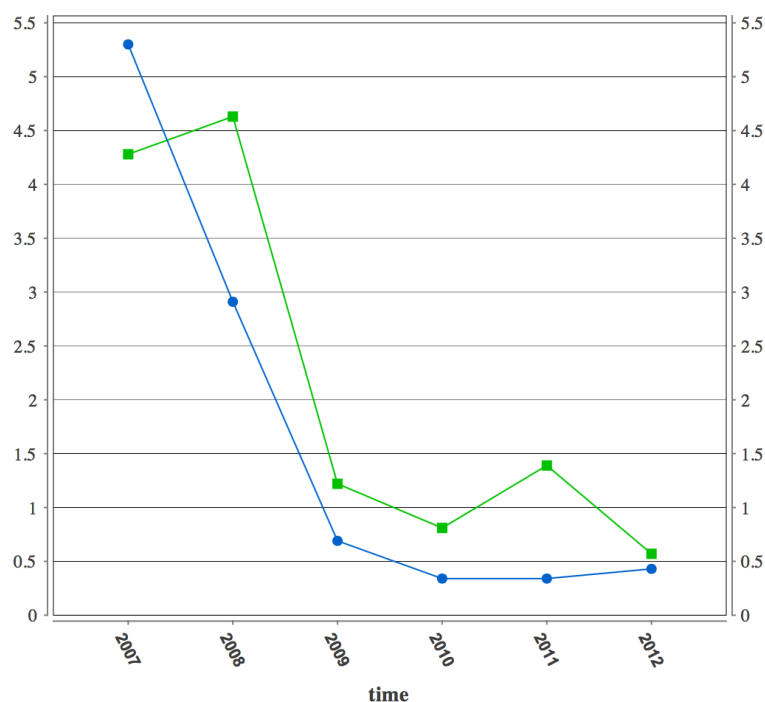
laboratory for analyzing policy shock; however, as elaborated in this chapter, using the CGE model without incorporating the financial sector would undermine the accuracy of the results. Thus, it is in this context that we subsequently use a financial CGE (FCGE) model where a fairly detailed financial block is incorporated into the CGE model.

The FCGE model is based on an expanded SAM by merging the flow of funds into it. In this way, total investment and total saving in the standard SAM will be augmented by investment and saving in financial asset. Hence, the new total investment and new total saving basically consist of two components – the real sector and the financial sector – maintaining the equilibrium tradition of equivalent investment and savings in CGE. In the language of the financial balance sheet, total assets ought to equal total liabilities. There are two major components to total assets – fixed assets and other assets, which include financial assets. Investment in the standard CGE model, the data of which are derived from SAM, is nothing but the fixed asset or real sector investment. Therefore, the bulk of other assets consists of financial assets such as securities, equities, and loans. On the liability side, the saving from the CGE model, derived from SAM, is equivalent to the wealth or net worth. For example, in the case of banks, these items typically consist of deposits made by the public and in some cases also loans from other banks (inter-bank loans) or other institutions. In recent years, many banks in emerging market economies have also raised financing from external sources. Given the ultra easy money policy in the advanced economies, especially after the global financial crisis, the incentive for many banks in emerging market economies to acquire external funding has increased significantly because the

cost of such funding is very low. For example, the short-term annual interest rate in the United States fell dramatically from 5.30 in 2007 to 0.43 percent in 2012 (see Figure 1.1). Similarly, the short-term interest rate adopted by European Central Bank fell from 4.28 in 2007 to 0.57 percent in 2012. This ultra easy money policy combined with Quantitative Easing (QE) has sparked massive capital outflows from advanced economies, most of which has gone to emerging market economies. Many banks in the latter have taken advantage of such an environment, raising the share of non-core liabilities (liabilities outside of deposits). At any rate, increased capital inflows have become a major phenomenon in most emerging market economies.

Figure 1.1. Short-term Interest Rates: Three-month Interbank Rates: Annual Average

Percent (Square= Euro Area, Dot = USA)



*Source of data: Eurostat

Following of the collapse of Lehman Brothers in the fall of 2008, the US economy fell into crisis. Subsequently, the economy of the Euro Zone area also encountered trouble. Both resulted in a global financial crisis, which also affected many emerging market economies. As a response, policymakers in emerging market economies have attempted to counter the downward pressure by implementing a series of stimulus policies. While there are several types of stimulus policies, almost all countries have used a fiscal stimulus by raising government spending. Given that most emerging market economies suffer from the perennial problem of worsening income inequality, it is expected that most of the physical stimulus are directed towards sectors that they believe will help raise the income of the poor while at the same time having a sufficiently large multiplier in the economy. Agriculture, construction (building), and trade fall in this category.

Given what is described above, in this chapter we impose a shock in terms of increased capital inflows and increased government spending in these three sectors. In raising government spending, we compare three cases: in the first case, no particular efforts are made to determine the sources of financing for the increased spending; the second case is based on raising direct taxes to finance the increased spending; and the last case finances the spending through government bond issuance.

We examined results from the CGE and FCGE models that demonstrate how the transmission mechanisms of the CGE model can be misleading and how the FCGE model differs from the real sector model. In particular, the equations defining the income of domestic institutions were modified such that the overall income includes

not only the factor income and income transfers from other institutions but also the income from financial investment (financial income). The resulting total income that includes earnings from financial returns is thus different from the income specified in CGE model.

1.2. Literature Review

One of the desirable features of economy-wide models is their ability to explicitly capture the link between micro and macro variables such that one can evaluate how the behavior of agents can influence and be influenced by the macro aggregates. When banks are taking more risks by investing in securities or derivatives instead of lending to the business sector, they will not stimulate real sector growth (GDP), which in turn will make banks more vulnerable. On the other hand, when the economic growth slows down because of, say, falling exports due to the global crisis, firms may decide to postpone their investment, and consumers may cut their spending, causing the economy to fall into recession. The nature and intensity of the abovementioned causal effects depend on the model specifications and the exact size of the parameters, all of which should reflect the behavior of different agents. Arguably, some equations in the model are non-linear. This is the essence of computable general equilibrium (CGE) models.

The basic theoretical underpinning of CGE frameworks is Walras' model of a competitive economy. The formal statement of a Walrasian economy can be found in the classic general equilibrium theory of Arrow and Hahn (1971) and Debreu (1959).

Scarf (1973) made the determination of the equilibrium of a Walrasian system possible. Calibration of the model parameters is based on real data to provide the empirical content to the purely axiomatic general equilibrium theory of Arrow-Hahn-Debreu.

The lineage of CGE models can be traced to the early work of Johansen (1960), who developed a linear model to deal primarily with distributional issues in Norway. In the model, quantities and prices are simultaneously determined with sectoral reallocation of labor and capital. This early category of CGE was of the neo-classical type, where producers are assumed to be profit maximizers in perfectly competitive markets, consumers are utility maximizers, and production factors are paid according to their marginal productivity. The solution of such a system provides a set of prices that clears all markets in one single instance, implying the presence of resource constraints (e.g., budget constraints) and full employment. The model is saving-driven, and no investment function is specified.

In the 1970s, the popularity of multisectoral analysis and macro models took off; most were used for policy analysis in developing countries. In general, the objective of using CGE is to analyze the quantitative effects of exogenous changes on the optimal allocation of resources, efficiency and welfare. In retrospect, this seems rather peculiar since most assumptions employed in the neo-classical CGE models do not hold in developing countries. Prices are not always formed by market clearing, and full employment condition is almost non-existent. At the time, the primary goal of the model was not to describe actual economies; instead, it was meant for constructing a ‘mental organizing framework’ that could be used to analyze a set of policy issues.

As efforts to reflect the actual economy grew, model conditions became less strict. Although the models are still generally based on optimizing representative agents and markets are cleared by endogenous prices, in some sectors the quantity clearing markets are not required. Certain production sectors are not modeled (Taylor, 1990). This is a departure from the standard neo-classical Walrasian CGE model.

Further development of CGE models puts the focus on the short-run income distribution, sectoral growth and trade balance effects, and less on resource allocation effects of exogenous shocks (Thissen, 1998). Behavior of economic agents is not necessarily derived from optimizing behavior. There is clearly a trade-off between keeping the internal rigor and the empirical relevance of the model, and the latter prevails. At the time, the use of CGE models for trade policy analysis was quite popular because most of the effects surrounding trade policy, such as those captured in the Stolper-Samuelson Theorem, are general equilibrium in nature. A good early survey of CGE models can be found in de Melo (1988) and Francois and Shiells (1994).

Meanwhile, new developments also took place on the data front. In recognition of the fact that household income distribution had become politically and economically more important than the traditional functional income distribution (i.e., between wage earners and capital owners, as traditionally used in the input-output framework), efforts were made to construct a comprehensive yet consistent data system that depicts the link between production and other blocks of the economy with the household income distribution. Such a data system, known as the Social

Accounting Matrix (SAM), also captures other sources of income outside factor income, such as transfers between different institutions. Clearly, this reflects the reality better and hence is more relevant than the input-output data system.

The SAM data system has other advantages as well. In the international trade context, one may want to analyze the average tax rate on imported goods and the proportion of imports of certain goods to the total supply. Often, it is also necessary to capture the impact of increased imports, say, due to tariff reduction on household incomes. Information of this nature cannot be investigated through input-output models. One may also wish to know the shares of non-factor incomes (transfers) received by different institutions (firms, government, banks, households) from abroad. Such information is absent in input-output but available in SAM. More generally, the analysis of capital flows can be made more accurately by using information from SAM. Structuralist CGE modelers took advantage of this development on the data front. Using SAM data, the structuralist models are demand-driven, unlike the saving-driven neo-classical model. A seminal work by Adelman and Robinson (1978) is a notable example. They are also among the first to attempt to integrate functional and household income accounts in the tradition of a SAM into a CGE model. A bibliographic survey of CGE models that have been applied to 26 developing countries, including the structuralist models, can be found in Decaluwe and Martens (1988). The countries covered by this study vary in their standard of living, policy orientations, degree of openness, and stage of industrialization. Another systematized account of CGE models can be found in the surveys done by Gunning and Keyzer (1995), and Ginsburgh and Keyzer (1997).

Among several components, closure in the models plays a critical role as it allows us to distinguish among different types of CGE models. Different types of closure give different results even when the structures of the two models are the same. In the neo-classical models, the closure specifies that aggregate investment is determined by aggregate saving, which is in turn determined endogenously through a fixed savings rate out of the after-tax income and government deficit. In the Johansen model, the closure specifies that aggregate investment is fixed exogenously and the savings rate is assumed to adjust in order to generate the required savings. Johansen (1974) argues that fiscal and monetary policies need to ensure that the generated savings will equal investment.

In a Keynesian framework, wage is usually set as the numeraire (also common in structuralist model, see Taylor, 1983, 1990). Investment is fixed, but labor supply is assumed to be endogenous. The adjustment in real wages is the macro equilibrating mechanism, while aggregate price is the equilibrating variable. If investment increases, savings must increase through rising income, which requires increased employment and output by way of falling real wages. To reach an equilibrium point, the latter requires an increase in the aggregate price. It is through this mechanism that the Keynesian multiplier is derived: an increase in investment yields a new equilibrium level of output, which equals to the multiplier $[1/(1-mpc)]$ times the investment increase. The model yields the same results if price level is chosen as the numeraire (wages become the macro equilibrating variable). The equilibrating mechanism in this case is as follows: real wages will adjust to create the employment necessary to generate income, the level of which will ensure that savings are equal to

investment.

Another type of Keynesian closure is where the price level is set as the numeraire and real wages are fixed. Labor supply is set free, so employment is not fixed. In contrast to the earlier Keynes specification, firms here are not in the demand curves for labor. A labor distortion parameter is hence introduced. This parameter measures the degree to which wages deviate from the marginal product of labor, and it will adjust until firms are induced to hire labor at fixed wages necessary to generate the income that will produce savings equals to investment.

In interpreting the distortion parameter, Barro and Grossman (1976) argued that since product and labor markets are out of equilibrium, firms are forced off their labor demand curves. The distortion parameter measures how far off they are. Another interpretation by Malinvaud (1977) emphasizes that firms are demand-constrained and rationed in the product market, and the distortion parameter measures the degree of this rationing. Either way, the equilibrating mechanism will be the same, i.e., employment is demand-determined, Keynesian multiplier is at work, and real wages remain constant.

While comprehensive and based on a robust economic theory, there is one important component missing from CGE models, i.e., the financial sector. Yet, irrespective of the economic system adopted, the role of the financial sector in most countries around the world is so great, especially in the post-liberalization period, that all aspects of the economy are directly and indirectly affected by the dynamics of this sector. When a fairly detailed financial module is incorporated into CGE, the simulation results of any shock are likely to be different than those generated by CGE models without a

financial module. The distinction between CGE with and without a financial module can be better explained by their respective simulation results when a particular shock is imposed in both models. In this chapter, I will do precisely that by analyzing the case of an emerging market economy – Indonesia.

Thissen (1999) provided an overview of financial CGE (hereafter ‘FCGE’) models. He shows the superiority of FCGE over standard CGE models in analyzing the stabilization and structural adjustment (SSA) programs advocated by the World Bank and the IMF in the 1980s. He argues that CGE models are inadequate to analyze the interactions between the real sector and the financial sector, resulting in inaccurate conclusions. Robinson (1991) surveyed FCGE models by emphasizing the role of loanable funds in micro and macro CGE models.

Despite their superiority, FCGE models also have some limitations. Thissen (1999) identified the following: (1) the difficulty to acquire financial data, especially different types of financial assets held by different agents; (2) the interactions within the financial sector as well as between the financial and real sector are often simplified; and (3) the parameters may need to be guesstimated, adopted from other studies, or assumed, due to the lack of readily available data.

Goodhart, Sunirand and Tsomocos (2004, 2005) emphasize the modeling of international financial flows and its effects, and disaggregate net investments by type of investor, banks, firms and the rest of the world. They also take into account the possibility of default to depict a financial fragility condition. Maldonado, Tourinho and Valli (2007) provide another example of an FCGE model where foreign capital flows are treated endogenously. Using the case of Brazil, they link capital flows with

the expected rate of loss of foreign reserves. Simulating the model for the case of Brazil joining a free trade agreement (FTA) as part of the trade policy, they conclude that the impact is significantly larger than without financial flows precisely because the financial flows amplify the impact of the policy.

Azis (2000a, 2000b) used an FCGE model to analyze the impact of the Asian financial crisis in 1997 on a set of social variables. By detailing the intricate mechanisms within the product and factor markets, and linking them with the financial market, he highlighted the role of real wages where urban households suffered more than rural households. In his subsequent and related work (Azis, 2001 and 2002), he used this structure to explain the phenomenon of reverse migration (from urban to rural). One of the key findings of his work is that the financial sector can play a significant role in affecting income distribution between different households. By adding a poverty module, he was also able to link the financial crisis with the trend of poverty where the poverty line and the income of poor households (i.e., the two determining variables in poverty measure) are endogenous.

Morley, Pineiro and Robinson (2011) developed a dynamic real-financial CGE model for Honduras. The key feature of their model is the incorporation of working capital as an additional factor of production, complementary to physical capital. This is considered to be important for short-run macro and trade policy analysis. Based on SAM, the model is recursive dynamic with short-run unemployment, where minimum wage is fixed and informal sector is treated explicitly. With the treatment of working capital, they examine the impact of monetary shocks that affect the supply of credit on the balance of payments, employment, and real income.

The use of flow and stock data is another important issue in FCGE modeling. Most data are usually denominated in flows, but models that allow for complete portfolio restructuring are preferred, in which both the stock and flow data are used simultaneously. An example of such models, also used in this chapter, is the portfolio model of Tobin (1967). Thorbecke (1991) is among those who used Tobin's portfolio model to analyze various SSA policy scenarios in the case of Indonesia.

In terms of the time dimension, CGE and FCGE models are generally suitable for analyzing medium-run repercussions of policy changes. The extent of model simulations should be long enough to allow for prices to adjust but short enough to assume that the model parameters are stable. Some also tried to construct dynamic CGE models to address various long-term issues ranging from long-term growth to environmental problems such as climate change. The dynamic models simulate the economic equilibrium for several successive moments in time, which are linked recursively through the trajectories of the state variables (see Rutherford and Tarr, 2005; Azis, 2009).

The model used by Morley, Pineiro and Robinson (2011) is another example of a dynamic CGE model with the financial sector. It is recursive dynamic, solved in two stages. First, the model determines a within-period equilibrium, given parameters and exogenous variables, then some parameters and exogenous variables are allowed to change over time. The model contains transition equations that determine how the exogenous variables and parameters relate to past solution values for particular endogenous variables. In some cases, these variables are assumed to grow according to trends. These transition equations provide values for all exogenous variables and

parameters for the next period for the static CGE model, which is then updated and solved for a new within-period equilibrium. In essence, they used the model to solve forward in a dynamically recursive fashion, with each static solution depending only on current and past values of variables and parameters. What is important to note about this feature is that the behavior of agents is based on historical information and adaptive expectations. It does not need to assume that agents have knowledge of the future. As in most dynamic models, the variables and parameters used as linkages between periods are the aggregate capital stock, exogenously determined population, domestic labor force, supply of working capital, factor productivity, export and import prices, export demand, tariff rates, and transfers to and from the rest of the world.

1.3. Methodology

1.3.1. The Dataset of The CGE Model: Social Accounting Matrix (SAM)

The Computable General Equilibrium model is descendant from the input-output (I-O) model pioneered by Wassily Leontief. The CGE model is based on the SAM dataset that includes the I-O model as a production sector. SAM is an integrated dataset consisting of national accounts, balance of payments, government budget, input-output table, and socio-economic surveys. SAM consists of multiple production sectors, multiple factors, and multiple institutions in matrix form. Each account interacts with the others in a circular fashion, providing a comprehensively detailed and quantified description of an economy. The SAM provides snapshots of the economy at a single point in time, and each cell of the matrix represents the value

of each transaction. There are five steps that form each cycle (see Figure 1.2): (1) Production activities captured in the I-O table generate value added – labor and capital – as factor income from the production activities; (2) factor income is distributed to the institutional sectors, which decide income distribution among households; (3) after paying taxes and transferring the income within different institutions; (4) the income is used by each institution to consume commodities from the production sectors while excess income is saved; and (5) this consumption pattern takes into account production activities affecting the level of output, export, and import. The new level of production activities generates a new level of value added and so forth. This circular flow represents the interdependency within/among production activities, production factors, income distribution, consumption, and transfer activities.

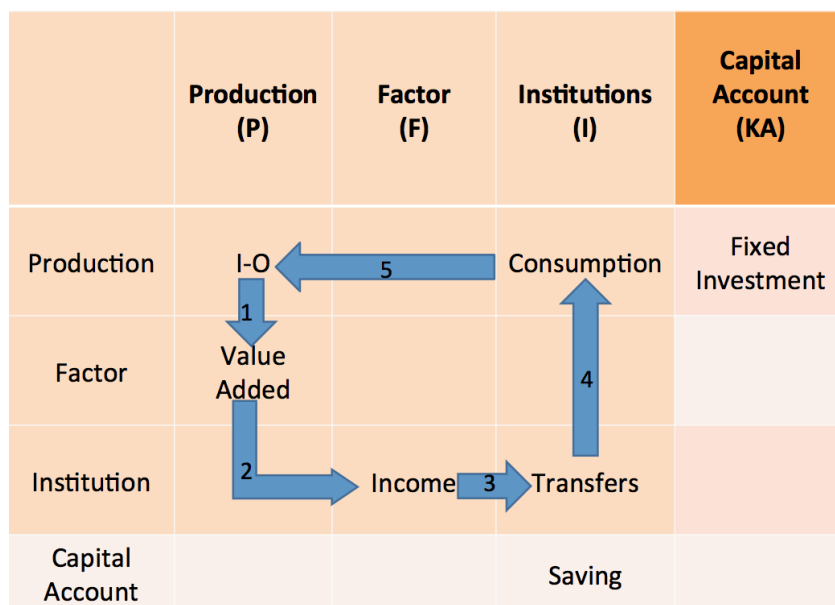


Figure 1.2. Structure of Social Accounting Matrix and Its Circular System.

The interactions are captured in multipliers (M^{SAM}) calculated by the following:¹

| | y | x |
|----------|----------|----------|
| y | D_{yy} | D_{yx} |

$y=f(x,y)$, where y is a set of endogenous variables and x is a set of exogenous variables.

$$dy = [I - D_y * F(x, y)]^{-1} D_x * F(x, y) dx$$

$$= [I - D_{yy}]^{-1} D_{yx} dx$$

$$dy = M^{SAM} \Delta x$$

Any change in the exogenous variable (Δx) will alter the endogenous variable y by M^{SAM} .

As a data system, however, SAM has some limitations in evaluating the impacts of the changes in one part of the economy on the rest because SAM as a data system assumes excess capacity, perfect elastic supply, linearity and no substitution effect. SAM also does not take into account behavioral features, and does not contain prices that play an important role as incentives in an economy. In other words, in SAM, there is no automatic partition of the transactions into the price and quantity. When there is a change, either from exogenous shock or endogenous change in demand and supply, the structure decides the magnitude of the change represented by the change in quantities but not in the change of prices. Although SAM is useful and comprehensive as a data system and modeling tool, a further extension is needed from the modeling point of view. One such extension is to endogenize the prices, to capture some optimizing behavior of different agents, and to allow the presence of excess capacity, different technology and substitution. This is where the computable general

¹ From Robinson, S., and Roland-Holst D.W., (1998)

² The values of excess market demands equals the values of excess market supplies

³ Sherman Robinson, David W. Roland-Holst, Macroeconomic structure and computable

equilibrium (CGE) model is distinguished from the dataset as a model.

1.3.2. The CGE model

The CGE model is based on the SAM dataset with prices assigned an endogenous role. When economic agents meet in the market, endogenous prices arise in the system that satisfy Walras' law.² CGE or Jacobian multipliers can show the difference between SAM as a data system and the CGE model.

CGE or Jacobian multipliers:

| | y | Z | x |
|----------|----------|----------|----------|
| Y | D_{yy} | D_{yz} | D_{yx} |
| Z | D_{zy} | D_{zz} | D_{zx} |

With the endogenous prices, the following system applies to the CGE framework.

$y=J(x,y,z)$, where y (quantity) and z (price) are both endogenous, and x is a vector of exogenous variables. A Jacobian multiplier can be derived:³

$$dy = [I - D_{yy} + D_{yz}(I - D_{zz})^{-1}D_{zy}]^{-1}[D_{yx} + D_{yz}(I - D_{zz})^{-1}D_{zx}]dx * J(x, y)]^{-1}$$

$$=M_y^{CGE} \Delta x$$

$$dz = M_z^{CGE} \Delta x$$

The Jacobian multiplier (M_z^{CGE} and M_y^{CGE}) captures the equilibrium dependence of the endogenous variables on one another as well as on exogenous

² The values of excess market demands equals the values of excess market supplies

³ Sherman Robinson, David W. Roland-Holst, Macroeconomic structure and computable general equilibrium models, Journal of Policy Modeling, Volume 10, Issue 3, Autumn 1988, pp. 353-375.

shock. If the three components (D_{yz} , D_{zz} and D_{zy}) in CGE are set to zero, then the above Jacobian multiplier becomes the SAM multiplier (M^{sam}). The SAM multiplier does not include prices, whereas the Jacobian multiplier takes prices in the system into account. The off-diagonal elements (D_{yz} , D_{zy}) denote linkages with prices. D_{zz} reflects the price interaction in the system, e.g., a policy lowering prices of some upstream industries has a favorable effect on the prices of some downstream industries. Hence, while the elements in the SAM multiplier matrix are positive numbers, the elements in the Jacobian have negative values reflecting the changes in prices. For example, demand increase for food processing industry will have a favorable impact on some agriculture sectors, which generates a positive multiplier; however, the increasing demand in agriculture products may have a negative impact on food processing because it raises prices of the forward industry's input market, which gives the multipliers negative values. Therefore, while the SAM multiplier results from an assumption of the excess demand, the Jacobian multiplier is adjusted according to price changes that extinguish the excess demand.

The CGE model is a deterministic model, not stochastic like most econometric models. It calibrates parameters and consists of a set of simultaneous equations. Thus, the CGE model has no pre-determined objective functions, while econometric models allow the error term (residual). Instead, the CGE model contains a set of equations that are numerically solvable and facilitate the ability of economic agents to find the best solutions given various macro and accounting constraints: the budget constraints of households and governments, the balance between trade balances, and the balance of payments. The CGE model is structured by equation blocks containing

characteristics of the economy: (1) production block; (2) price block; (3) income block; (4) expenditure block; (5) market clearing block; (6) GDP & utility block; (7) distortion block; (8) subsidy block; and (9) transfer block. Each block contains a set of corresponding equations. These blocks will be explained in detail in the FCGE model section.

The CGE model consists only of real sector variables mentioned above as the SAM dataset deals with real sector savings and investment in one combined account. Treating each real sector saving and investment as one capital account misses one of the most dynamic sectors in the economy – namely, the financial sector. One might argue that in SAM, the relationship between real sector and financial sector performance might be somehow explained by using one capital account that contains gross savings and investment information of institutions. Given that real sector investment depends not only on economic agents' own savings but also on bank loans and other financial assets, in reality, savings are not only spent on physical assets but also on financial assets. In particular, the source of funds for investments can also come from other sources, such as loans, deposits, and savings. Such transactions became very critical since the Financial Sector Liberalization (FSL) in the 1980s. In almost all developing countries, financial assets play an important role as an alternative source of financing for banks. As financial institutions and instruments have been developed, the asset markets have become a crucial means for the investments and savings of economic agents. Therefore, the transactions cannot be bundled into one account and cannot be analyzed in the same way that SAM treats the capital accounts. Without the financial sector in the system, the analysis may be

biased, especially for social issues such as poverty analysis. While every investment is assumed to generate employment in models without the financial sector, investment in financial assets may in fact not be generating employment. Also, a financial boom may inflate asset prices and hence affect other social indicators – the poverty line and income – through inflation, while the effects maybe underestimated in the CGE model without this explicit channel. In addition, the absence of the financial sector excludes the fact that investors in financial assets are not poor households and hence income distribution may be worsened when financial assets are incorporated into their income. Given the critical role of the financial sector in modeling and in reality, the sector should be specified and allowed in the model to acquire accurate economy-wide impacts from any shocks or policies. When it comes to policy analysis related to the financial sector, the CGE model without any financial accounts is not adequate.

1.3.3. The Dataset of The FCGE Model: Financial Social Accounting Matrix (FSAM)

As mentioned earlier, although the CGE model is useful to analyze economic impacts on the real sector, neglecting the behavior and specifications of the financial asset market can mislead the analysis of any economic impact.

The Financial Computable General Equilibrium model introduces asset markets and loanable funds markets by disaggregating the capital account in SAM and incorporating the flow of funds (FOF) table into the dataset, which now becomes the Financial Social Accounting Matrix (FSAM). The FOF contains most flows of investments and savings occurring from simultaneous decisions of economic agents,

which allows us to track where the different assets of various institutions are being spent and used. Based on the FOF, the savings and investments in the capital account of SAM are disintegrated into investments for the real sector (investment), investments for the financial sector (assets), savings from the real sector (savings), and savings from the financial sector (liability), (see Figure 1.3). In SAM with the FOF, thus, it can be elaborated that saving consists of saving and wealth, while total investment consists of physical investment and financial investment.

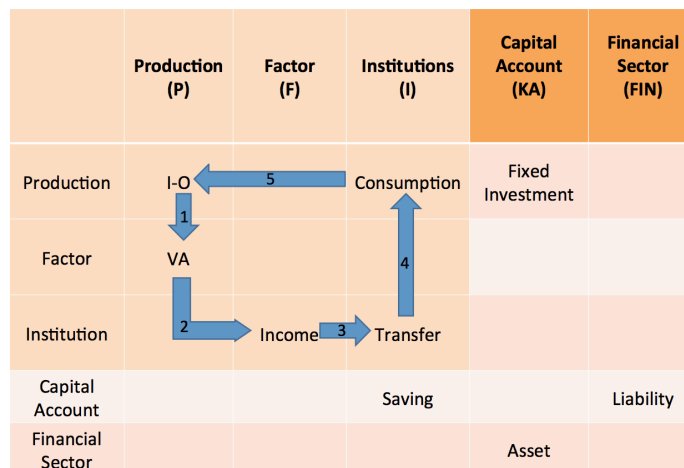


Figure 1.3. Structure of FSAM Matrix and Its Circular System.

Table 1.1. An Example of Balance Sheets Built According to FSAM

| Rural rich household | | | | Banking sector | | | |
|--------------------------|-------------------|-------------------|--------------------------|--------------------------|-------------------|-------------------|--------------------------|
| Asset | | Liability | | Asset | | Liability | |
| Fixed investment | 6934.929803 | 45570.81834 | Wealth | Fixed investment | 4313.891 | 45510.923 | Wealth |
| Money demand | 3516.574254 | 0.00 | Money demand | Money demand | 6068.076547 | 36679.119 | Money demand |
| Saving deposit | 14342.58647 | 0.00 | Saving deposit | Saving deposit | 44053.693 | 134275.048 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate | Central bank certificate | -40271 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond | Government bond | -805.917 | 0.00 | Government bond |
| Short-term securities | 0.00 | 0.00 | Short-term securities | Short-term securities | 4815.016 | 579.175 | Short-term securities |
| Credits | 764 | 2516.151055 | Credits | Credits | 144973.9969 | 5148.2266 | Credits |
| Equity&share | 303 | 0.00 | Equity&share | Equity&share | -64.845 | 3805.97 | Equity&share |
| Others | 23507.87887 | 1282 | Others | Others | 38016.78956 | 579.175 | Others |
| | <u>49368.9694</u> | <u>49368.9694</u> | | | <u>201099.701</u> | <u>201099.701</u> | |

By incorporating FOF, the FSAM can elaborate information on the assets and liabilities of the financial sector as well as savings and investments of the real sector. The model based on the FSAM finally is able to specify the loanable funds markets with a variety of different assets, such as currency, demand deposits, saving deposits, time deposits, central bank certificates, government debt (bonds), other long-term securities, short-term securities, working capital credit, investment credit, consumption credit, non-bank credit, trade credit, equity and shares, and insurance pension fund reserves. This information appears to be the balance of payment for each institution as shown in Table 1. FSAM can provide a consistent and coherent statistical framework for both the real and financial sides of the economy. Hence, whereas most macro-econometric models imperfectly specify flows of income among agents, the FCGE gives a comprehensive and detailed quantified description of the macro-economic and financial interrelations by linking the real sector, the social sector, and the financial sector.

1.3.4. The FCGE model

The FCGE model takes into account endogenous prices in the system like the CGE model. In addition to the prices in the real sector, the FCGE model includes financial asset prices, allowing us to analyze the impact associated with asset prices, such as price bubbles, which precluded many past crises.

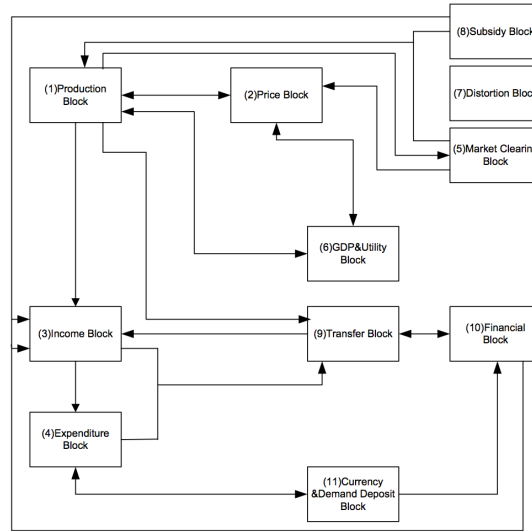


Figure 1.3. Interrelationship among the blocks in the FCGE Model

Table 1.2. Variables in Each Block in CGE and FCGE Models

(Social indicators written in bold)

| FCGE blocks | | | | | | | | | | |
|------------------------------|---|---|------------------------------|------------------------|-----------------|---|--------------------------|-------------------------------|---|-------------------------------------|
| CGE blocks | | | | | | | | | (10) Financial | (11) Currency&De mand Deposit |
| (1) Production | (2) Price | (3) Income | (4) Expenditure | (5) Market Clearing | (6) GDP&Utility | (7) Distortion | (8) Subsidy | (9) Transfer | | |
| Export(E) | PE, World Price of Export(PWE) | Household Income(YF) | Consumption(CD) | Unemployment (UEMP) | GDP | Indirect tax(IDTAX) | SUB | Income transfer(INTRAN) | Return(RN), Avera ge return(AVGRN) | Money Demand(MD) |
| Import(M) | PM, PWM, Tariff Margin(TTM) | Total Income(INC) | Government Spending (GD) | | RGDP | Imperfect Competition (IMPERFECT) | Export subsidy (SUBE) | Government transfer(GTRAN) | Asset stock (ASSETS), Liability stock(LIABS) | |
| Factor Demand (Facdem) | Price of Labor(PL), Price of Capital(PK), Wage(WF) | Total Income Distribution between poor and rich(YDISTLH) | Saving (SAV) | | | TARRIF | Import subsidy (SUBM) | | Initial asset stock (ASSETLAG), Initial liability stock(LIABLAG) | |
| Supply(Q) | Price of Supply(PQ), Price of Domestic goods(PD) | Total Income Distribution between rural and urban(TDISTRU) | Foreign Saving (FSAV) | | | | | | Asset flow (ASSET), Liability flow(LIAB) | |
| Output(X) | Price of Output(PX) | | Exchange rate(EXR) | | | | | | | |
| Value Added(VA) | Price of Value added(PV) | | Expenditure(Exp) | | | | | | | |
| Intermediate Input(INTM) | PINTM, PDINTM, PMINTM | | Total Investment (INVEST) | | | | | | | |
| Direct Tax(DIRTAX) | Price Index(PINDEX) Poverty line(PL) | | | | | | | | | |

With detailed information on the financial activities of each institution, the FCGE model is structured both by CGE blocks containing real sector variables (1 to 9) and by FCGE blocks containing financial sector variables (10 and 11): (1) production block; (2) price block; (3) income block; (4) expenditure block; (5) market clearing block; (6) GDP and utility block; (7) distortion block; (8) subsidy block; (9) transfer block; (10) financial block; and (11) currency and demand deposit block as shown in Table 1.2. Each block includes a set of equations and its corresponding variables. The production block contains export (E), import (M), factor demand (FACDEM), supply (Q), value added (VA), intermediate inputs (INTM), and taxes. The price block consists of each price of the production variables and price index (PINDEX). The income block has variables and equations for factor income (YF) and total income (INC) after transfers. The expenditure blocks are for the relationships among consumption (CD, GD), saving (SAV), foreign saving (FSAV), investment (INVEST), expenditures (EXP), investment demand (ID), and exchange rate (EXR). The unemployment variable (UEMP) is in the market-clearing block. GDP and utility blocks contain variables and equations regarding yield GDP and RGDP. The distortion block is for tariffs (TARIFF), indirect taxes (IDTAX), and imperfect competition (IMPERFECT). The subsidy block contains subsidies to export, import, and households given by government. Transfer variables and equations are included in the transfer block. Government transfers (GTRAN) is included in income transfers (ITRAN). Financial blocks show the relations through the equations for financial assets (Asset, AssetSLag, and AssetS), liabilities (Liab, LiabSLag, and LiabS) and corresponding financial returns (RN and AvgRN). The money demand (MD) of

institutions, consisting of currency and demand deposit, is included in the currency and demand deposit block. All blocks dynamically interact with each other in the FCGE model. Especially, (10) financial block and (11) currency and demand block only exist in the FCGE model, taking into account the transactions from FOF information. The connections between real sector blocks (1 to 9) and financial sector blocks (10 to 11) represent the interaction between real and financial sectors in an economy. In the income block of the FCGE model, financial income – defined as return (RN) multiplied by financial asset (Assets) – is added to the total income (INC). As part of the income (INC) of each institution, any changes in the financial sector will alter financial income, resulting in changes in total income. Also, part of the investment originally intended for financial sector (Asset) can be used for real sector investment (INVEST) – secondary investment channel. The increase of financial wealth therefore can lead to real sector investment increases in the real sector. In addition, money demand (MD) of the economic agents as part of financial assets plays an important role in the economy. Affected by income and interest rates, the money demand also subsequently affects the income of the institutions through changing financial return (RN) and asset composition, affecting consumption (CD) and production activities sequentially, i.e., central bank's income. Furthermore, the FCGE model incorporates behavioral aspects associated with the investment of each institution in financial assets. Economic agents' decisions as to how much to invest in which financial assets affects their wealth and thus the entire economy. The decision criteria whereby economic agents allocate their wealth (money) to various financial assets, in particular, are essential to the income of households, as well as profits of

firms and the government. Furthermore, the criteria can often be influenced by shocks or policies. Although the FCGE model is a bridge between the real sector and the financial sector, the model itself does not provide a complete explanation of the actual behavior of economic agents in allocating their wealth in financial assets. The FCGE used in this thesis takes into account Tobin's theory to incorporate the behaviors of institutions into financial asset allocation. In this model, only the allocation theory for rural households is applied.

According to Tobin, the decisions of economic agents or investors depend not only on the relative returns on financial assets but also on risk factors in investing the financial assets. In other words, the risk factors involved in possessing the asset influence investors' decisions. Tobin's theory captures both criteria as follows:

$$\frac{gh1_{rh}}{1 - gh1_{rh}} = phi h1_{rh} * \left(\frac{1 + RNDP}{1 + RNNDP} \right)^{esph1_{rh}}$$

$gh1_{rh}$ is an allocation variable as to how much rural households allocate their money to demand deposit. $phi h1_{rh}$ and $esph1_{rh}$ are risk parameters. $RNDP$ is the return on demand deposit, and $RNNDP$ is the return on other assets excluding demand deposit. $esph1_{rh}$ is a risk that is embedded in the return on the asset, in this case demand deposit; whereas $phi h1_{rh}$ is a external risk that exists other than the financial asset, i.e., regulations, and financial crises from other countries. If there is a case of no risk in the financial asset, then the risk parameter, $esph1_{rh}$, is set to zero, leaving the right-hand side one. In reality, however, other external influences exist to keep the investors from putting money in demand deposit accounts. $phi h1_{rh}$ reflects this external risk.

The model with detailed information about the financial assets and liabilities of institutions, thus, is empirically more reliable. Furthermore, given the interplay between the real sector and the financial sector in reality, any policy and/or impact analysis that does not consider the impact of the financial sector will be misleading. Therefore, especially for policy analysis with financial variables, a financial CGE model where the financial sector is specified in greater detail is preferable to a standard CGE model.

1.3.5. Comparing The CGE and FCGE models⁴

In the previous section, the presence of a financial block and demand deposit block distinguishes the FCGE model from the CGE model as shown in Table 1.2. This section articulates and compares the channels and their effects –Feature 1.1, Feature 1.2, and Feature 1.3 – these effects distinguish the FCGE model from the CGE model.

⁴ See Appendix in Chapter 2 for the description of equations, variables, and parameters.

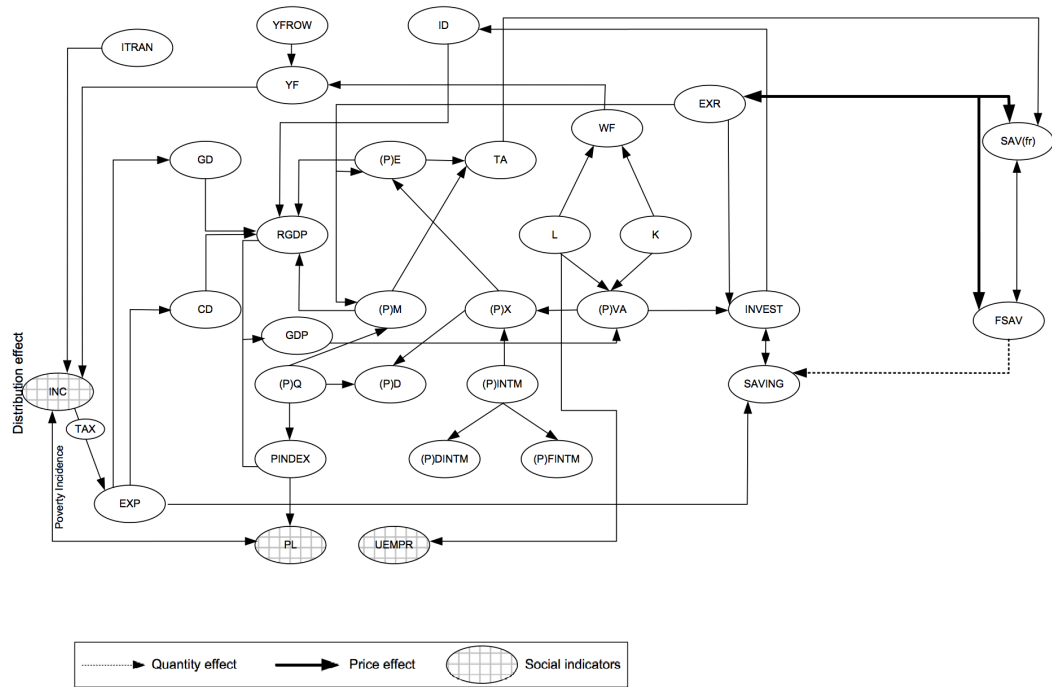


Figure 1.3. The Interrelationship Among the Variables in The CGE Model

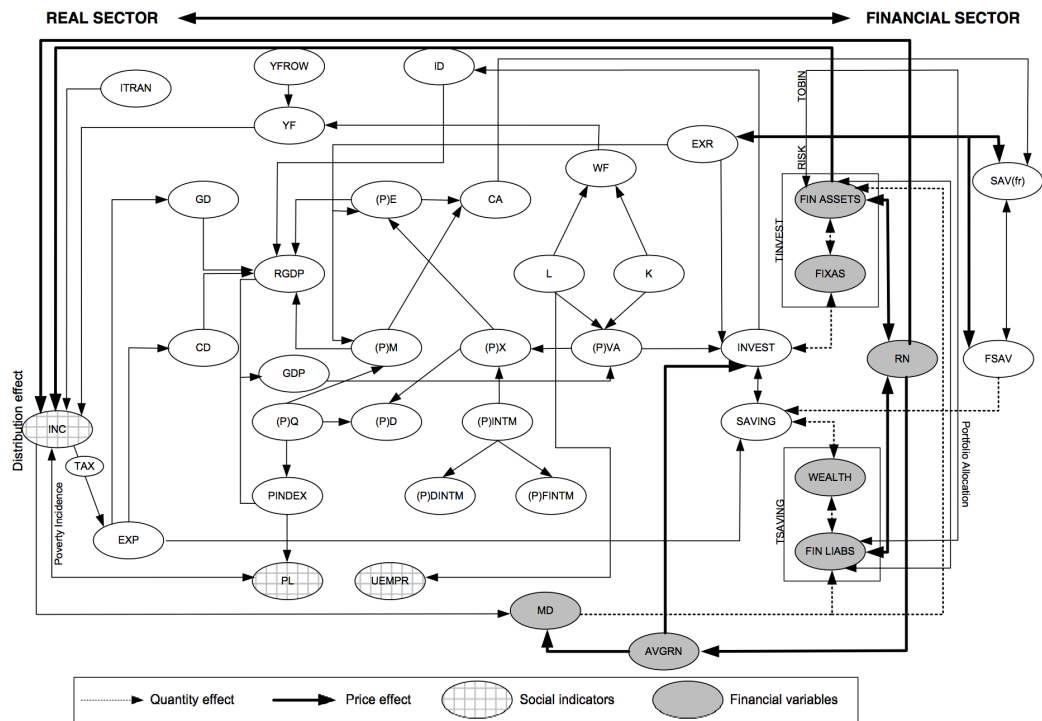


Figure 1.4. The Interrelationship Among The Variables in The FCGE Model⁵

⁵ See Appendix I for the description of the variable names.

Feature 1.1. Quantity effect: total investment = total saving

CGE: $INVEST_{in} = SAVING_{in}$

Total physical investment = Total saving from real sector

FCGE: $TINVEST = \sum_{as}(AssetS_{as,in}) + INVEST_{in}$
Total investment = Total financial sector investment + Total real sector investment

$TSAVING = \sum_{as}(LiabS_{in,as}) + SAVING_{in}$
Total saving = Total financial liability + Total real sector saving

$$TINVEST = TSAVING$$

Feature 1.1.1. Investment

CGE: Physical investment alone

- $INVEST = \sum_i \sum_{in} INVES_{i,in}$ (Eq. 1)

Total Physical Investment by all institutions

- $INVES_{i,frm} = \lambda_{0i} * VA_i^{\lambda_{1i}} * (AvgRN)^{\lambda_{2i}} * EXR^{\lambda_{3i}}$ (Eq. 2)

Real sector investment by firms is affected by value added, interest rate, and exchange rate. avgRN is an average asset of the returns on 17 financial assets. VA_i is the value added in sector i (output accelerator). EXR is the exchange rate, and AvgRN is the average return rate. $\lambda_{0i}, \lambda_{1i}, \lambda_{2i}, \lambda_{3i}$ are constant (positive, positive, negative and negative, respectively).

FCGE: Physical + financial investment

- $FixA_{in} = \sum_i INVES_{i,in}$ (Eq. 3)

Total flow of physical investment by the institutions, which is the same as Eq. 1

- $FixAS_{in} = FixASLag_{in} + FixA_{in}$ (Eq. 4)

Total physical investment at the end of period consists of the real sector investment at the beginning of period and the change between two periods.

- $TINVEST = \sum_{in} (\sum_{as}(AssetS_{as,in}) + FixAS_{in})$ (Eq. 5)

Total investment that occurred both in the real and financial sector in an economy

- $INVES_{i,frm} = \lambda_{0i} * VA_i^{\lambda_{1i}} * (avgRN)^{\lambda_{2i}} * EXR^{\lambda_{3i}}$ (Eq. 6)

In the CGE model, ‘investment’ means investment in the real sector or physical investment as shown in Eq. 1; however, in reality, economic agents invest not only in physical products such as land, building, and machines but also in financial instruments. In the FCGE model, investment (Eq. 5) includes financial investments, such as investment in stocks as well as physical investment. The total investment box in Figure 2 includes both. Both physical and financial assets consist of the stock at the beginning of the period and changes within the period, yielding a total stock value at the end of the period. Furthermore, the investment of firms (Eqs. 2 and 6) in both models depends on the value added (VA), average interest rate (AvgRN), and exchange rate (EXR). The average interest rate in the CGE model is an equilibrating factor to adjust the level of real sector investment of financial institutions, whereas the AvgRN in the FCGE model is an average weighted return on all financial assets (Eq. 25). The domestic investment depends on the economic cycle – value added – positively, interest rate negatively, and exchange rate negatively. If EXR collapses, as it often does during crises, institutions with high leverage on short-term and un-hedged foreign debt experience magnified debt burdens. Also, since the returns are endogenously weighted in the FCGE model, any changes either from real or financial sectors in the economy can alter the rates. The interaction through returns will be explained in detail in Feature 1.2.

Feature 1.1.2. Savings

CGE: Saving solely from real sector activities

- $SAV_{din} = INC_{din} - EXP_{din}$ (Eq. 7)
Saving by domestic institutions is their income after taking into account expenditures

such as consumptions and transfers.

- $FSAV * EXR = \sum_{fr} SAV_{fr}$ (Eq. 8)
Foreign saving is in domestic currency by taking into account exchange rate.

- $SAV_{in} = SAV_{in} + SAV_{fr}$ (Eq. 9)
Total saving is the saving from real sector activities of all institutions.

FCGE: Savings from real sector activities + Financial liability

- $WEALF_{in} = SAV_{in}$ (Eq. 10)
WEALF is a different name for saving in the FCGE model

- $Wealth_{in} = WealthLag_{in} + WEALF_{in}$ (Eq. 11)
Real sector saving at the end of period equals the saving at the beginning of period plus the changes between the two periods.

- $FSAV * EXR = \sum_{fr} SAV_{fr}$

- $LiabS_{in,as} = LiabSLag_{in,as} + Liab_{in,as}$ (Eq. 12)
Financial liability at the end of period is the liability at the beginning of period plus the changes between the two periods.

- $TSAVING = \sum_{as}(LiabS_{in,as}) + Wealth_{in}$ (Eq. 14)
Total saving is the financial liability and saving from real sector activities at the end of period.

In the CGE model, savings indicate the remaining income after spending through transfers and consumption (Eq. 7). Savings (TSAVING) in the FCGE model, however, includes not only the savings from real sector activities ($WEALF_{in}$) but also savings from financial sector activities, such as debt and issued bonds. These savings are from the liabilities on the balance sheet of an economy (Eq. 12). Total savings in the FCGE model, thus, consist of the savings at the beginning of period ($\sum_{as}(LiabS_{in,as})$) and the changes within the period ($Wealth_{in}$), yielding the total saving at the end of period (Eq. 14).

Feature 1.1.3. Money demand

CGE: Money demand channel does not exist.

FCGE: Money demand is a part of financial assets.

- $MD_{in} = \alpha_{in} * (INC_{in}^{\alpha_{in}2}) * (r_{nv1}_{in}^{-\alpha_{in}3})$ (Eq. 15)
The money demand is a function of income and average interest rate on non-money assets.

- $r_{nv1}_{in} = (\sum_{nasm} (r_{nasm} * AssetSLag_{nasm,in})) / (\sum_{nasm} AssetSLag_{nasm,in})$ (Eq. 16)
The average interest rate used in the money demand function equals interest rates on non-money demand.

- $AssetSLag_{asm,in} = mdshare_{asm,in} * MD_{in}$ (Eq. 17)
Money demand is a part of the financial assets of the institutions.

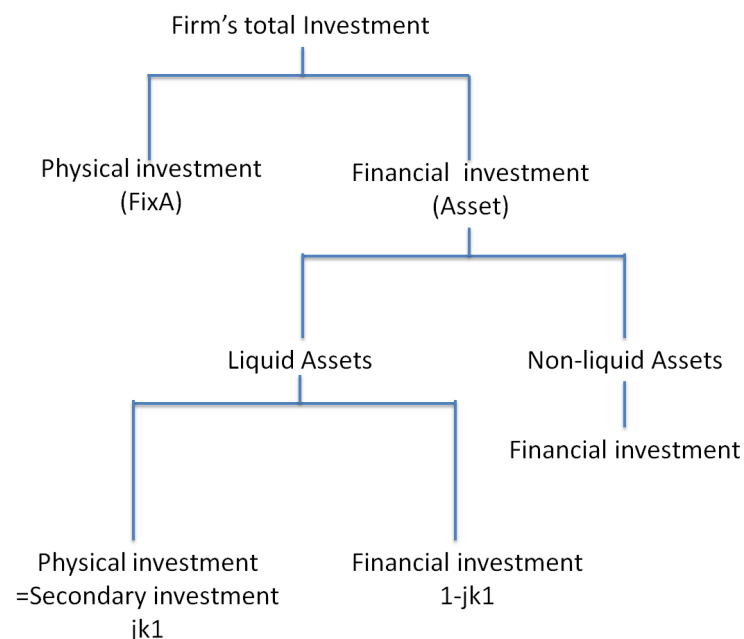
- $LiabS_{in,asm} = mdshr_{in,asm} * (\sum_{in2} AssetS_{asm,in2})$ (Eq. 18)
Money demand is a part of the financial liability of the institutions.

Money demand in reality is the demand for currency and demand deposit, and is part of financial assets; however, the money demand in the CGE model can only be implicitly assumed by the trend of the interest rates and output. If interest rates increase, the money demand in the CGE model is assumed to lower. Also, if output increases, the money demand in the CGE model is assumed to increase; however the model does not yield money demand or anything associated with the demand of the economy since there is no such equation or data for the analysis in the model. In the FCGE model, in contrast, money demand, as part of financial assets, is explicitly expressed as a function of income and the average interest rate (Eq. 15). Therefore, changes in the demand for money (MD) due to changes in income and/or interest rates will form a new financial asset composition of institutions (Eq. 17, and see Figure1.4). The new compositions of assets determine the financial asset size and, in turn, the level of both financial and real investment in the economy. The change in money

demand (MD) will also affect the average interest rate (AvgRN) through the changed interest rate on money demand (Eq. 16). In the CGE model, however, such a money demand equation is not specified to analyze the impact of any policy on money demand and its subsequent effect in the economy as shown in Figure 1.3.

Without the financial sector, therefore, investment in the CGE model – solely real sector investment – will generate employment, but the resulting number can be overestimated because when excess savings are spent on financial assets, the employment elasticity tends to be lower than if the savings are invested in the real sector. Therefore, any event in real sector investment (FixA) will affect financial assets (Asset) and vice versa through changes in the amount of investment as well as the prices (returns).

Feature 1.1.4. Secondary Investment



- $\sum_{firm} (FixA_{firm}) =$

$$\sum_{i,firm} (INVES_{i,firm})$$

$$+ \sum_{firm} (jk1_{firm} * (\sum_{assec,firm} ((RNSEC.L - RNSEC0) * Asset_{assec,firm}))$$

$$+ \sum_{ascr,firm} ((RNCR.L - RNCR0) * Asset_{ascr,firm}))$$

$$+ \sum_{aseq,firm} ((RNEQ.L - RNEQ0) * Asset_{aseq,firm}))) \quad (Eq. 19)$$

Real sector investments of the firms consist of the investment originally intended for the real sector, and the real sector investment apportioned from financial sector investment – secondary investment.

- $\sum_{firm} (FixAN0_{firm}) =$

$$\sum_{i,firm} (INVES0_{i,firm})$$

$$+ \sum_{firm} (jk10_{firm} * (\sum_{assec,firm} ((RNSEC.L - RNSEC0) * Asset0_{assec,firm}))$$

$$+ \sum_{ascr,firm} ((RNCR.L - RNCR0) * Asset0_{ascr,firm}))$$

$$+ \sum_{aseq,firm} ((RNEQ.L - RNEQ0) * Asset0_{aseq,firm}))) \quad (Eq. 20)$$

The name of the variable representing EQ is FixAN.

- $\sum_{as,firm} (Asset_{as,firm}) = \sum_{as,firm} (Asset_{as,firm}) - FixAN + \sum_{i,firm} (INVES_{i,firm})$ (Eq. 21)

The financial investment of a firm equals the investment originally intended for the financial sector minus the amount of real sector investment apportioned from the financial sector investment.

- $\sum_{firm} \frac{jk1_{firm}}{1-jk1_{firm}} = pajk1 * (\frac{1-RNCR}{1+RNCR})^{pbjk1}$ (Eq. 22)

The secondary investment depends on the real sector interest rates represented by the interest rates on credit assets and returns from financial investment. The amount of the real sector investment is negatively associated with the credit interest rate and interest rates for financial assets.

- $\sum_{firm} (jk0_{firm}) =$

$$\frac{\sum_{assec,firm} (Asset0_{assec,firm}) + \sum_{ascr,firm} (Asset0_{ascr,firm}) + \sum_{aseq,firm} (Asset0_{aseq,firm})}{\sum_{as,firm} (Asset0_{as,firm})} \quad (Eq. 23)$$

The secondary investment is initially equivalent to the amount of liquid-able financial assets, such as security, credit and equity assets in the case of firms. The proportion of liquid financial assets to total financial assets affects the secondary investment.

The parameter weighing how much the ratio of real sector to financial sector interest rate affects the

ratio of secondary to financial investment is as follows:

$$\bullet \quad pajk1 = \left(\sum_{firm} \frac{jk1.L_{firm}}{1-jk1.L_{firm}} \right) * \left(\frac{1+RNCR.L}{1-RNCR.L} \right) pbjk1 \quad (\text{Eq. 24})$$

Total real and financial sector investment is:

$$\bullet \quad TINVEST_{in} = \sum_{as} (AssetS_{as,in}) + FixAS_{in}$$

In reality, the interaction between the financial sector and real sector can occur through apportioning the financial assets between real and financial sector investment as well as through transferring the earnings from financial investments. For example, someone's stock purchase can allow the firm to have more capital to invest in the real sector either to expand the business or to open a new one. Thus, while real sector investment is solely intended for the real sector and therefore remains in the real sector, financial investment can be divided into two types: (1) financial investment remaining in the financial sector $(\sum_{as,firm} (Asset_{as,firm}) - FixAN + \sum_{i,firm} (INVES_{i,firm}))$, and (2) real sector investment, which is apportioned from the financial investment: $(\sum_{firm} (jk1_{firm} * (\sum_{assec,firm} ((RNSEC.L - RNSEC0) * Asset_{assec,firm}) + \sum_{ascr,firm} ((RNCR.L - RNCR0) * Asset_{ascr,firm}) + \sum_{aseq,firm} ((RNEQ.L - RNEQ0) * Asset_{aseq,firm}))))$). Assuming that 30% of the entire investment in the economy is invested in the real sector and the remainder in the financial sector, some of the financial investment can be allocated to real sectors, depending on the investment decision of economic agents. The decision can depend on the composition of the financial assets: whether it is liquid-able or not, and the earning difference between real and financial investments (Eqs. 22 and 23). Thus, an increase in financial

investment can also help expand real sector investment although the direct and indirect contribution of this are likely less than direct investment in the real sector (Eq. 19).

In order to incorporate this mechanism into the model, the equations in the financial block of the FCGE model were added and modified. In the model, a variable (λ_1) decides the proportion of financial investment between secondary investment and the investment remaining in financial sector. The allocation depends on the type of asset –whether liquid-able or not – and the relative interest rates of the real (RNCR) and the financial sectors (RNNCR).

Feature 1.2. Price Effect

Feature 1.2.1. Interest Rate and Financial Returns

CGE: An endogenous variable

- $AvgRN0$ =interest rate
- $INVES_{i,fin} = \lambda_{i,fin} * VA_i^{\lambda_{i,fin}1} * (avgRN)^{\lambda_{i,fin}2} * EXR^{\lambda_{i,fin}3}$ (Eq. 2)
Real sector investment by financial institutions affected by value added, interest rate, and exchange rate. AvgRN is an average asset of the returns on 17 financial assets.

FCGE: A set of endogenous variables for each financial asset

PARAMETER RN0(as) interest rate

| | | |
|--------|--------|----------------------------------|
| FINA1 | 0.0338 | Government's Forex Reserves |
| FINA2 | 0.0001 | Currency |
| FINA3 | 0.0342 | Demand deposit |
| FINA4 | 0.0432 | Saving deposit |
| FINA5 | 0.0813 | Time deposit |
| FINA6 | 0.0918 | Central Bank Certificate (SBI) |
| FINA7 | 0.0909 | Government Bonds |
| FINA8 | 0.1259 | Other Long-term Securities |
| FINA9 | 0.0812 | Short-term Securities |
| FINA10 | 0.1405 | Working Capital Credit |
| FINA11 | 0.1420 | Investment Credit |
| FINA12 | 0.1628 | Consumption Credit |
| FINA13 | 0.1942 | Non-bank Credit |
| FINA14 | 0.0227 | Trade Credit |
| FINA15 | 0.1422 | Equity & Share |
| FINA16 | 0.1058 | Insurance, Pension Fund Reserves |
| FINA17 | 0.0995 | Others |

- $avgRN = \frac{\sum_{as} \sum_{in} RN_{as} * AssetSLag_{as,in}}{\sum_{as} \sum_{in} AssetSLag_{as,in}}$ (Eq. 25)

The return on total financial asset

- $RNshare_{in} = \frac{\sum_{asrn} RN_{asrn} * AssetSLag_{asrn,in}}{\sum_{asrn} \sum_{in2} (RN_{asrn} * AssetSLag_{asrn,in2})}$ (Eq. 26)

Asset share of institutions

- $rna1_{in} = (\sum_{asdp} (rn_{asdp} * AssetSLag_{asdp,in})) / (\sum_{asdp} AssetSLag_{asdp,in})$ (Eq. 27)

The return on demand deposit; currency and demand deposit

- $rna2_{in} = (\sum_{asgb} (rn_{asgb} * AssetSLag_{asgb,in})) / (\sum_{asgb} AssetSLag_{asgb,in})$ (Eq. 28)

The return on government bond

- $rna3_{in} = (\sum_{assec} (rn_{assec} * AssetSLag_{assec,in})) / (\sum_{assec} AssetSLag_{assec,in})$ (Eq. 29)

•

The return on securities: short-term and other long-term securities

- $rna4_{in} = (\sum_{ascr} (rn_{ascr} * AssetSLag_{ascr,in})) / (\sum_{ascr} AssetSLag_{ascr,in})$ (Eq. 30)

The return on credit assets: working capital, investment, consumption, non-bank, and trade credits

- $rna5_{in} = (\sum_{aseq} (rn_{aseq} * AssetSLag_{aseq,in})) / (\sum_{aseq} AssetSLag_{aseq,in})$ (Eq. 31)

The return on equity

- $INVES_{i,firm} = lambda0_{i,firm} * VA_i^{lambda1i} * (avgRN)^{lambda2i} * EXR^{lambda3i}$ (Eq. 6)

In the CGE model, the interest rate exists as an equilibrating factor. It is the only interest rate in the model used to adjust the level of real sector investment of financial institutions (Eq. 2). In contrast, in the FCGE model, the interest rate is specified as a weighted variable where the weights depend on the changes in the asset values (Eq. 25). The various initial interest rates ($RN0(as)$) for each financial asset are determined by the flow equilibrium in the lendable funds market. That is, the interest rates ($AvgRN$ and RN) are endogenously determined along with changes of the financial asset values (Eqs. 27-31) given any shock (see $AvgRN$ and RN in Figure 1.4). Therefore, the level of inflation in a standard CGE model without the financial sector

is likely to be underestimated as it is completely isolated from asset price increase (during a boom period) or decrease (during a crisis). Yet, the price level is the most critical factor in determining not only the aggregate level of the economy but more importantly social indicators such as the level of poverty (PL), income, and regional disparity (YDIST) (Figure 1.4).

Feature 1.2.2. Exchange rate

CGE & FCGE

- $PM_i = PWM_i * EXR * (1 + tm_i + ttf_i - psubm_i)$ (Eq. 32)
Domestic prices of import goods depend on the world prices of import goods, taxes, tariffs, subsidies, and exchange rate.
- $PE_i = \frac{(PWE_i * EXR)}{(1 - psube_i)}$ (Eq. 33)
Domestic prices of exports depend on the world price of export goods, subsidies, and exchange rate.
- $FSAV * EXR = \sum_{fr} SAV_{fr}$ (Eq. 8)
Foreign saving in domestic currency value is the foreign saving in dollar value multiplied by exchange rate.
- $INVES_{i,firm} = \lambda_{i,firm} * VA_i^{\lambda_{i,firm}1} * (avgRN)^{\lambda_{i,firm}2} * EXR^{\lambda_{i,firm}3}$ (Eq. 6)
Real sector investment by firms depends also on exchange rate.

The presence of financial markets in the FCGE model is critical in analyzing any changes in the exchange rate. The exchange rate plays an important role not only in export and import (Eqs. 32 and 33) but also in financial markets. For export-led countries such as those in East Asia, it plays a critical role in influencing the profit of firms, which in turn influence production and real sector investment. Although this effect can be analyzed through the investment equation (Eq. 6) in the CGE model, the balance sheet effect, which is highly associated with exchange rate, can only be

elaborated under the availability of information on the balance of payments of each institution. For example, the CGE model can show that firms' investment is affected negatively by exchange rates as shown in Eq. 6. However, it does not elaborate how the negative effect is transmitted through the institution's balance sheet, also shown in Figure 1.3. In the FCGE model, domestic investment is affected negatively by exchange rates through the balance sheet effect. When EXR is depreciated, the balance sheet of institutions – especially those highly leveraged in foreign currency – will be damaged. The debt denominated by foreign currency will be increased on the liability side of the institution. This magnified debt burden due to the depreciated exchange rate has a negative impact on investment decisions of the institution. Highly leveraged institutions tend to decrease investment during this period, and vice versa for the EXR appreciated case. The negative balance sheet effect that is due to the EXR depreciation will actually be analyzed through the changes in the composition of financial liability and assets as well as in its physical investment in the model. The changes in the composition of financial liability and assets can also have various impacts on the economy. Although the depreciated exchange rate can be helpful for export in the case of export-led countries, the decline in investment might be large enough to outweigh the export effect through the balance sheet effect. Although the CGE model can show the effect of the exchange rate on investment, the outcome under the absence of a specified balance sheet can be smaller than it is supposed to be. Thus, the impact of EXR depreciation or appreciation can be underestimated by excluding the financial markets because the impact reaches only the real economy through changes in the volume and price of exports and imports and changes in

physical investment.

Feature 1.3. Distribution Effect (Income Distribution)

CGE: Financial income does not exist in the model.

- $INC_{ngi} = \sum_f (factoin_{ngi,f} * YF_f) + \sum_{in2} ITRAN_{ngi,in2}$ (Eq. 34)

Incomes of non-government institutions consist of their salary and income transfers. Return earnings are transferred to income.

- $INC_{gin} = \sum_f (factoin_{gin,f} * YF_f) + \sum_{in2} ITRAN_{gin,in2} + (gishr_{gin} * \sum_i (INDTAX_i + TARIFF_i))$ (Eq. 35)

Income of government consists of factor income, income transfers, indirect taxes. Return earnings are transferred to income.

FCGE: The earnings from financial activities (financial income) are included in the total income of each institution.

- $INC_{ngi} = \sum_f (factoin_{ngi,f} * YF_f) + \sum_{in2} ITRAN_{ngi,in2} + \sum_{as} Asset_{as,ngi} * RN_{as}$ (Eq. 36)

- $INC_{gin} = \sum_f (factoin_{gin,f} * YF_f) + \sum_{in2} ITRAN_{gin,in2} + (gishr_{gin} * \sum_i (INDTAX_i + TARIFF_i)) + \sum_{as} Asset_{as,gin} * RN_{as}$ (Eq. 37)

- $YDISTLH = \frac{(INC_{HHH1} + INC_{HHH3})}{(INC_{HHH2} + INC_{HHH4})}$ (Eq. 38)

- $YDISTRU = \frac{(INC_{HHH1} + INC_{HHH2})}{(INC_{HHH3} + INC_{HHH4})}$ (Eq. 39)

In the CGE model, the income is comprised of factor income and income transfers received from other institutions. This does not include any financial income, which is financial asset multiplied by financial returns (Eq. 34). In the FCGE model, however, financial income should be part of the income of any economic agents given the availability of detailed information on who has which financial asset. As the

financial income is included in the income equation, the income is now affected by any changes in the financial sector (Eqs. 36 and 37). This, in turn, will cause a series of changes in both the real and financial sectors as the economic agents with new income levels will respond accordingly. The new income level that is due to the changes in the financial returns or the volume of financial assets will affect real sector variables, such as consumption, savings, investment, production, and price. All of these changes subsequently affect financial variables, including wealth, returns, and asset compositions, resulting in an amplified impact again on real sector variables. More importantly, it will affect social indicators, in particular, improving or worsening income and regional inequalities (Eqs. 38 and 39). The two models will, therefore, yield two different values of income distributions under the same shock. Subsequently, the impact of any shocks not only on the income distribution but also of income distribution on the economy will differ. This difference between the two income distributions in the CGE model and in the FCGE model given a shock will be demonstrated in the following section. The summary of the comparisons is provided in Table 1.3.

Table 1.3. Summary of Three Different Key Channels in CGE and FCGE models

| | CGE | FCGE |
|----------------------------|--|--|
| Quantity effect | Investment=real sector investment (eq. 1) | Investment=real+financial investment (eq. 5) |
| | Saving is used only for physical investment (Eq. 9) | Saving is also used for financial investment as well as physical investment (eq. 14) |
| Price effect | Interest rate is equilibrating factor | Interest rate is weighed average. Financial returns shape real sector prices. (eq. 25) |
| Distribution effect | Income consists of transfer and factor income (eq. 35) | Income consists of transfer, factor, and financial income (eq. 36) |

1.4. Analysis

As shown in Table 1.4, four different scenarios are explored by using the CGE and FCGE models: three cases under fiscal expansionary policy – (1) government spending increased without source specification, (2) increased by 30% through tax, and (3) increased through government bonds; and (4) capital inflows increased by 20%. Exactly the same closures are applied to the four models.⁶ The scenario where the government increases the spending through government bonds is applied only to the FCGE model, as government bonds is one of the financial assets that does not exist in the CGE model. It is assumed that government increases the spending on agriculture, building, and trade sectors. These are the sectors that often involve either public projects or small-scale activities. Government in particular raises funds through increasing direct taxes on factor income, or through issuing more government bonds.

⁶ See Appendix II.

In the case of increasing capital inflow, FSAV shock is used in which foreign saving is increased (see Figures 1.3 and 1.4). In this chapter, we compared each corresponding scenario from the CGE and FCGE as shown in Table 4: (Section 1.4.1) comparing the results from the CGE and FCGE models under the scenario where the government increases spending, though the source is not specified; (Section 1.4.2) comparing the results from the CGE and FCGE models under the scenario where the government increases the spending through tax under CGE model; (Section 1.4.3) comparing the results from the baseline economy and FCGE models under the scenario where the government increases spending through government bonds, and comparing results from the FCGE models under tax and under government bond issuance (GD); and (Section 1.4.4) comparing the results from the CGE and FCGE under the scenario where the economy experiences capital inflows.

Table 1.4. Analysis Conducted in This Chapter⁷

| | CGE Scenarios | | FCGE Scenarios | | |
|-------|--|-----|--|-----|--|
| 1.4.1 | Government spending (GD) increased by 30% | Vs. | GD increased by 30% | | |
| 1.4.2 | 30% of GD increase through tax financing | Vs. | 30% of GD increase through tax financing | | |
| 1.4.3 | | | 30% of GD increase through tax financing | Vs. | 30% of GD increase through government bond (GD) issuance |
| 1.4.4 | Foreign capital inflow (FSAV) increased by 20% | Vs. | FSAV inflows increased by 20% | | |

⁷ See Appendix II for closures used in each scenario.

In the FCGE case, we specifically distinguish household incomes from factor income and income generated through the return of financial assets (financial income). Such distinction is important in order to trace the sources of income. Even when the shock originates in the real sector, the resulting incomes from these three sources will not be the same.

1.4.1. GD Increase Without A Specified Source

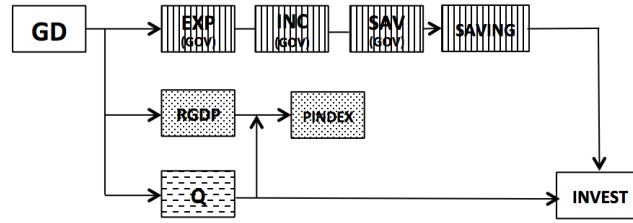


Figure 1.5. Immediate Transmission Channels by GD Increase in CGE Model

In the CGE model, as shown in Figure 1.5, the immediate transmission channels from GD that increased by 30% are as follows: (1) an increase in GD will immediately change the level of government's expenditure (EXP), income (INC), and saving (SAV), resulting in a change in total saving (SAVING) in the economy; (2) an increase in GD will change real GDP (RGDP) as a component of RGDP;⁸ (3) an increase in GD will increase the demand for products, increasing supply (Q) and affecting price index (PINDEX). In turn, changes in SAVING, RGDP, Q, and PINDEX affect the entire economy through various channels. For example, increased supply will also increase the demand for intermediate inputs (INTM), value added

⁸ $RGDP = \sum_i (CD_i + ID_i + GD_i + \sum_i E_i - \sum_i (1 - TMREAL0_i) * M_i)$

the return transfer channel. Through the economy-wide impact, the new income distribution will also alter the consumption and saving pattern.

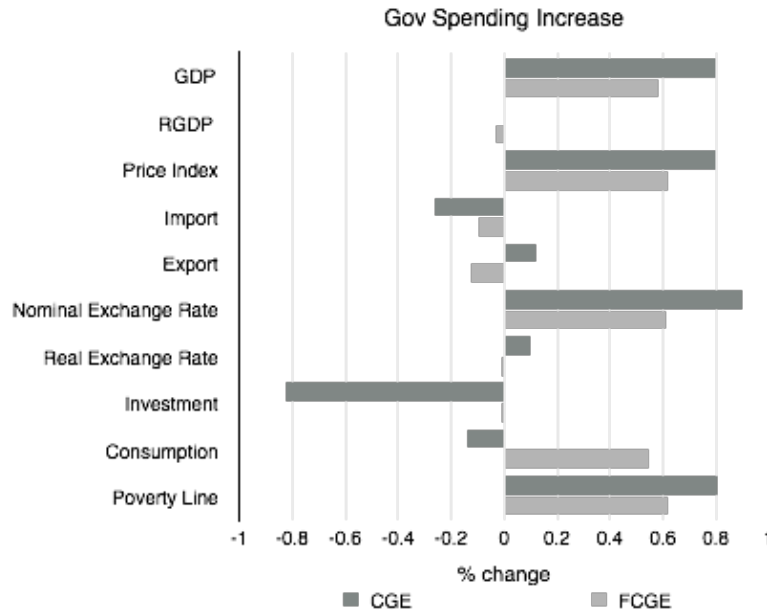


Figure 1.7. Comparing the Results from CGE and FCGE Simulations of GD Increase

As shown in Figure 1.7, under the fiscal expansionary scenario, the size of growth effect in the CGE model is smaller than that in the FCGE model. The growth would reflect the trend of other macro-economic variables, such as employment and investment. Although the investment of the private sector declines in both models, the fall in the FCGE is less than in the CGE model. The fall of investment is due partially to the crowding-out effect and the balance sheet effect as the exchange rate depreciates under this scenario (more depreciation causes less investment, see Eq. 6 in the previous section). While the exchange rate in the CGE model primarily affects export,

trade and transportation margin (TMREAL).

import, and investment, in the FCGE model it goes further by affecting also the balance sheet and wealth of different agents.

Using this channel, one can distinguish the sources of financing of increased government spending in more detail, including from government's financial assets. For example, if the government issues bonds to finance the 30% increase in spending, this will appear in the liability side of the balance sheet of government (section 1.4.2). Alternatively, another source of financing may come from an increase in direct taxes as described in this section.

1.4.2. GD Increase Through Tax

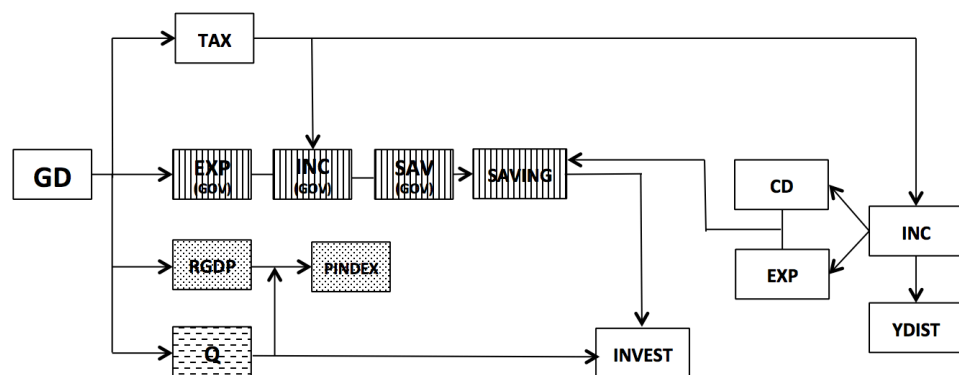


Figure 1.8. Immediate Transmission Channels by GD Increase Through an Increase in Direct Tax in CGE Model

simulations indeed yield different outcomes depending on the presence of the financial channel. The results with the presence of financial income in the FCGE show worsening income distributions as shown in Figure 1.10.

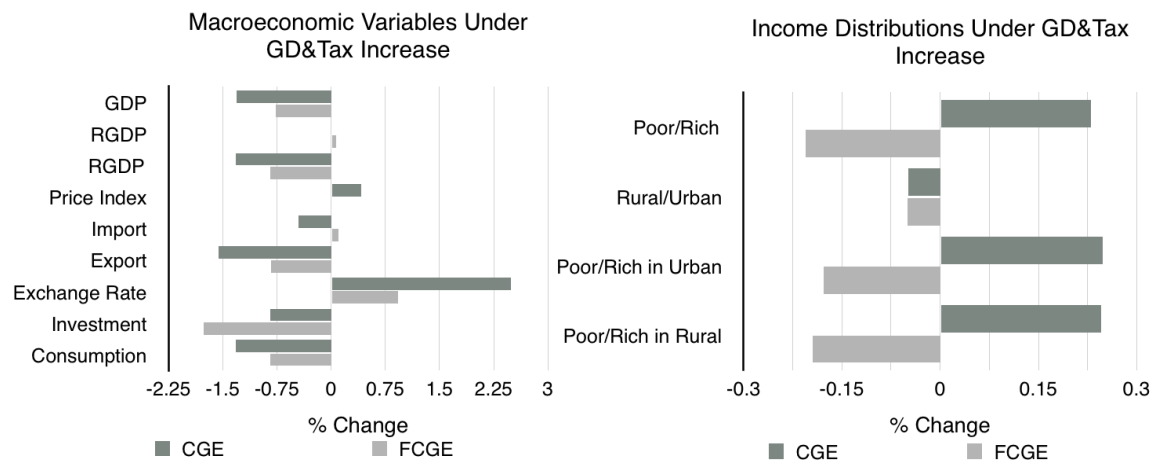


Figure 1.10. Comparing the Results from the CGE and FCGE Simulations of GD Increase Through Tax

When the government raises funds for spending increases through tax, GDP decreases while RGDP increases as the price declines in both CGE and FCGE simulations (see left chart in Figure 1.10). Investment increases in both models because government spending induces real sector investment by the private sectors, i.e., building industry. The domestic firms' investment (Eq. 6) captures that the firms experience a positive balance sheet effect when the exchange rate appreciates.

Since the appreciated EXR lowers the foreign currency debt burden of the private sector, the latter is in a better position to pursue investment in the real sector. In both models, export and consumption decrease due to exchange rate appreciation and falling income, respectively. Real sector investment in the FCGE is less than that

in the CGE because of the presence of financial investment in the FCGE model. The economy supported by the increase in GD also boosts financial sector investment, which cannot be captured in the CGE model. Incomes of all non-government institutions decrease in the CGE model. With the exception of the banking sector, the same applies to the simulation results using the FCGE model. Although the tax increase has a negative effect on the income of agents in both models, the effect is larger in the CGE simulation; however, in terms of the resulting relative income distribution, the FCGE simulation is worse than in the CGE simulation. This difference in income distribution demonstrates the importance of incorporating the financial sector. The CGE model underestimates the income distribution because it excludes the dynamics of distribution that works through financial sector channels.

The results of increased tax to support government spending turn out to be more unfavorable to poor than to rich households. While the tax increase has a negative effect on the factor income, which is a critical source of income for the poor, it has little impact on the poor's financial income. Since rich households have much higher financial incomes, the resulting financial income distribution between the poor and the rich worsens. In the CGE model, the absence of inflation has created a favorable effect on the poverty line (measured by the quantity of basic needs multiplied by the price of those commodities); however, to determine the precise effect on poverty, one must also examine the impact on the income of the poor (Azis, 2008). As depicted in Table 1.5, the total incomes of both rural and urban poor households decrease even more than the poverty line. Since the percentage decline of the poverty line is less than the percentage decline of the income of the poor, it is

likely that the incidence of poverty increases.¹⁰ Therefore, the presence of the financial sector under the GD and tax increases exacerbates the income inequality and poverty.

Table 1.5. Comparing Household Incomes under Different Scenarios in FCGE Model.

| | | Baseline Economy | GD&Tax | GD&GB |
|-------------------|------------------|------------------|-------------|-------------|
| Rural Poor | Total income | 99997.49 | 99722.96 | 100005.60 |
| | Factor Income | 35300.35 | 35025.83 | 35308.46 |
| | Income Transfer | 11430.64 | 11430.64 | 11430.64 |
| | Financial Income | 53266.50 | 53266.50 | 53266.50 |
| Urban Poor | Total income | 69423.69 | 69276.96 | 69425.00 |
| | Factor Income | 19241.92 | 19095.19 | 19243.23 |
| | Income Transfer | 52661.49 | 52661.49 | 52661.49 |
| | Financial Income | 43703.47 | 43703.45 | 43703.47 |
| Rural Rich | Total income | 7569676.50 | 7563574.70 | 7569961.90 |
| | Factor Income | 702917.91 | 697359.17 | 703178.04 |
| | Income Transfer | 52661.49 | 52661.49 | 52661.49 |
| | Financial Income | 6814097.10 | 6813554.10 | 6814122.40 |
| Urban Rich | Total income | 31081027.00 | 31070755.00 | 31081602.00 |
| | Factor Income | 1162517.60 | 1153240.50 | 1163037.30 |
| | Income Transfer | 200760.48 | 200760.48 | 200760.48 |
| | Financial Income | 29717749.00 | 29716754.00 | 29717804.00 |

¹⁰ The incidence of poverty measured as a headcount of poverty is the number of people living below the poverty line. Therefore, lower poverty line and higher income of the poor implies a lower headcount of poverty.

1.4.3. GD Financed Through Government Bond (GB) Issuance

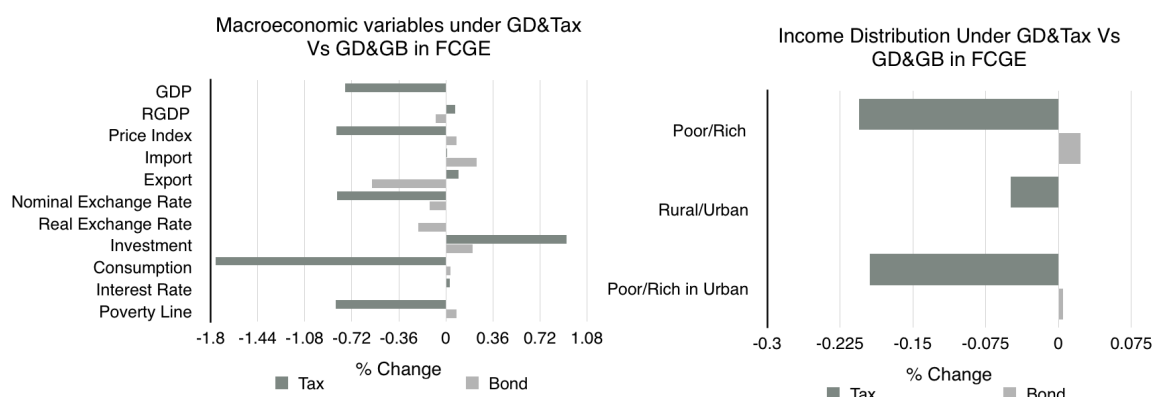


Figure 1.11. Comparing Results from FCGE Simulation of GD Increase Through Tax Increase and GB Issuance

When the government increases their spending through the issuing of government bonds, this gives better results in the economy overall. If one focuses on improving the income distribution and poverty, increasing government spending through government bond issuance might be the right policy.

Under the scenario where the spending is financed through the issuance of government bonds, the economic growth is higher than when financed through an increase in taxes (Figure 1.11). The inflation is also higher and the exchange rate is depreciated more. While the spending increase through tax is negative to the income of the economic agents, spending increase through the issuance of bonds is positive to the income of the economic agents. The RGDP, however, is decreased because of inflation. Investment here is even less increased than the tax increase cases in the FCGE model because of the increased availability of government bonds as financial

Therefore, the issuance of the government bond itself already results in a series of changes in the financial sector by changing the composition, investment, returns on other assets, and wealth of other agents. The changes of asset composition in the balance sheet include the changes in fixed investment (INVEST or FixA) and money demand, affecting real sector variables such as investment, consumption, and so forth.

As shown in Chart 4, the level of growth under this scenario is higher than in the CGE and FCGE model with a tax increase. Compared with the CGE model, this scenario in the FCGE models shows that the income distributions between poor and rich, and between rural and urban areas, have not been improved as much. It might be that the financial sector corrects the overestimated income of rural and poor households. The real sector investment is, however, smallest when the government finances it through government bonds as compared to the case of tax in the CGE and FCGE. From the FCGE simulations under these two sources of financing, it was found that the economy would experience less inflation than in the CGE model simulation. Although, compared to the results in the baseline, the income distribution between rural and urban regions improves, it is worse than the results in the CGE simulation.

Government investment is only associated with real sector investment in the CGE model, while in reality government invests in financial assets as well as real sector. The government finances the funds by issuing bonds, stocks or borrowing money from banks. The FCGE thus can show how the government finances in order to boost economy or where the money is coming from; however, in the CGE model, the money can only come from a tax increase, which will require decreasing other variables due to the equilibrating process given the exogenous government spending.

1.4.4. Capital Inflows

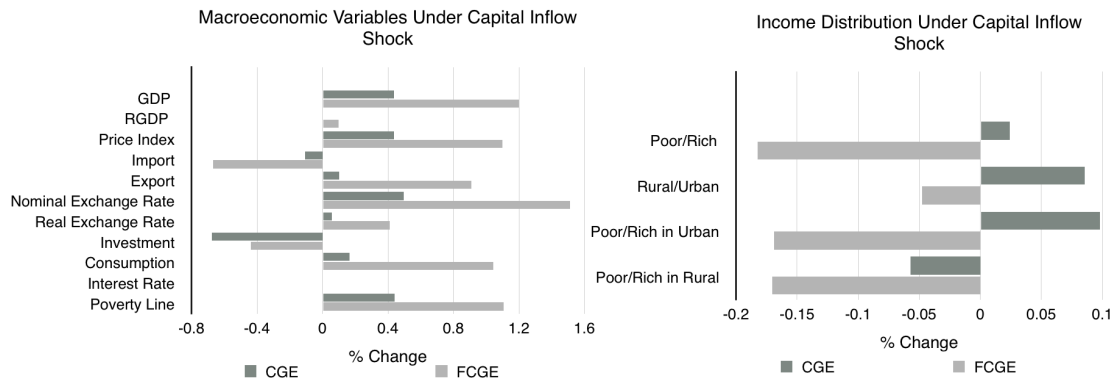


Figure 1.13. Comparing Results from CGE and FCGE Simulations of Capital Inflows

The results from the FCGE model show that an increase in capital inflows has an expansionary effect on the overall economy as shown in left chart in Figure 1.13. The real GDP, investment, consumption, and import all increase such that the labor market is benefited as indicated by the decline in unemployment rate. Given the critical role of non-financial firms in real sector investment, the increase in their income, particularly financial income, might facilitate an increase in real sector investment. The capital inflows that favor the balance sheets of lenders and borrowers also tend to raise the domestic financial assets. This is demonstrated by an increase in the financial returns, short-term securities, and equity and share. The rising return of financial assets along with the growing economy would have placed pressure on price levels; however, the endogenously determined interests rates in the model play a role as one of the equilibrating factors. As shown in Figure 1.13, the interest rates (AVGRN) increase, countering the inflationary pressure. The resulting appreciated EXR provides an additional countermeasure on prices such that the price

level declines. Overall, therefore, the economy expands without inflationary pressure, although export declines. The absence of inflation has created another favorable effect on the poverty line as measured by the quantity of basic needs multiplied by the price of those commodities; however, to determine the precise effect on poverty, one must also examine the impact on the income of the poor (Azis, 2008). The total income of both the rural and urban poor decrease slightly (0.0081% and 0.00189% respectively); however, since the percentage increase of the poverty line (1.1065%) is greater than the percentage increase of the income of the poor, it is likely that the incidence of poverty declines as well.¹¹ Therefore, overall, the capital flows have been beneficial to the economy when macro and micro economic indicators are considered; however, the results show a different story when it comes to income inequality between the poor and rich. Along with the decreases in financial income of the poor in rural and urban areas, the income distribution between poor and rich, and between rural and urban areas, worsened, especially the financial income distribution between poor and rich. This supports my hypothesis that the beneficiaries from the financial sector development will be those who possess the financial assets – namely, the rich. Furthermore, while the total incomes of non-financial firms, government, banks, and urban rich household are increased (particularly their financial income), the total incomes of the rural poor, urban poor, and rural rich households are decreased. This even strengthens the argument that the benefits of financial booms are directed mostly toward rich agents in the economy.

¹¹ The incidence of poverty, measured as a headcount of poverty, is the number of people living below the poverty line. Therefore, lower poverty line and higher income of the poor implies a lower headcount of poverty.

The results from the CGE show that increase in capital inflows has some negative effect on the overall economy, while the FCGE economy was better off due to the financial sector boom. Under the CGE model, GDP is underestimated because the model neglects the dynamics of the financial sector such that prices and exchange rate are incorrectly estimated. The RGDP, investment, and imports in the CGE model are all decreased while inflationary pressure persists. The un-weighted interest rate without the information about each return on financial assets was unable to quench the inflationary pressure. The exchange rate here was even depreciated in order to increase the import prices. Notice that the exchange rate here is depreciated although inflow causes EXR appreciation. This is because price plays a critical role in the direction of the EXR in the model. The price increase due to the capital inflow keeps the exchange rate from appreciating and even pushes it upward to depreciate. The poverty line is raised, showing the increase in poverty incidence. As observed already in the FCGE model, however, since the percentage decline of the poverty line is greater than that of the income of the poor, it is likely that poverty incidence does not increase. The difference between the CGE model and the FCGE model stands out when it comes to income disparities (Figure 1.13). The income level of all agents, particularly the rural poor and rich, and urban poor are inflated because the financial income effect was not taken into account. In the FCGE model, the income of the poor was decreased due to the decline in the financial income of the poor (Figure 1.14). This financial income does not exist in the CGE model, resulting in an inflation of the income of the poor and other institutions. Furthermore, this CGE model shows improved income distributions between poor and rich, and between rural and urban

areas. This is precisely why the CGE model misses the financial channel that plays a critical role in determining the income inequality between the poor and rich in the economy. Thus, if one tries to analyze the impact of capital inflows based on the outcome from the CGE model, the analysis can be misleading, especially in terms of income changes and income distributions.

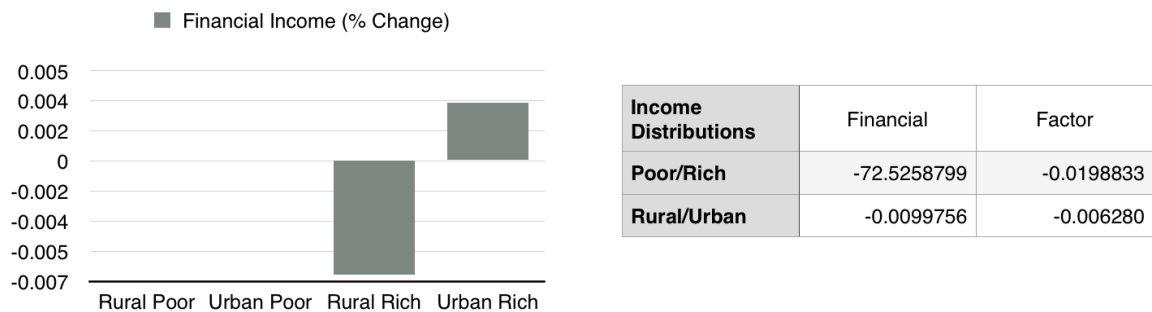


Figure 1.14. % Changes in Financial Income (left) and Income Distribution Under Capital Inflow Shock in FCGE Model

1.5. Concluding Remarks

In this chapter, we argue that the financial sector should not be neglected in the analysis based on an economy-wide general equilibrium model. By comparing CGE with and without the financial sector (FCGE versus CGE), we show that the results of CGE model simulations without the financial sector could be underestimated. This is clearly detected when we shock the two models with increased government spending. The macroeconomic outcomes of the shock are not encouraging primarily because the price level tends to rise, but the results from the FCGE model show much worse

outcomes than those of the CGE model. More seriously, the social indicators generated from the shock are diametrically opposing; the CGE model produces unfavorable social conditions, while the results from the FCGE model simulations are more favorable than before the shock. When it is further assumed that the increased spending is financed by taxes, changes in the social outcomes are also in opposite directions, i.e., income distribution improves under the CGE and worsens under the FCGE. Clearly, ignoring the financial sector in CGE may lead to inaccurate results. The derived policy implications could therefore be mistaken.

Sharply distinct outcomes are also detected when the models are shocked with increased capital inflows. The social conditions improve under the CGE model but worsen under the FCGE model. Even when both models produce some improvements in macroeconomic variables, the improvements under the CGE model are much lower than under the FCGE model, because the macro and financial channels that are directly influenced by the increased capital inflows are activated under the latter model, where many macro and social variables are eventually affected.

The superiority of the FCGE over the CGE model can be clearly seen from the transmission mechanisms when a particular shock is imposed. To demonstrate the complete mechanisms of the FCGE model, two alternative financing models for increased government spending are compared – one through taxes and the other through the issuance of government bonds. The macroeconomic results of the latter are more favorable than those of the former because financing spending through the issuance of bonds hardly causes changes (increases) in prices. Since price changes play a key role in the transmission mechanisms, improvements in most variables due

to increased spending are essentially not costly. Looking more closely at the simulation results of the FCGE and CGE models, one can see that an increase in government spending financed through the issuance of bonds causes the exchange rate to appreciate less in the FCGE model, consumption to fall less, and the nominal GDP to increase although it falls in the real term. The endogenously-determined interest rate also falls, although the resulting inflation is likely higher. The social variables are clearly better when increased spending is funded through the issuance of government bonds. The poverty line increases much less, while the income of the poor increases, suggesting that poverty incidence declines. Furthermore, the relative income distribution is also better.

On the shock of increased capital inflows, without any policy response, the scenario will worsen the spatial income distribution (between rural and urban areas) under the FCGE model but not under the CGE model. Most financial benefits of capital inflows are enjoyed by high-income urban-based households through increased returns from financial assets, while the rural-based households lack access to financial assets and hence cannot reap the benefits of the growing financial sector associated with increased capital inflows. It is expected that the resulting rural-urban income inequality will deteriorate. The absence of mechanisms that cause changes in income and returns from financial assets, as is the case in the CGE model, prevents us from incorporating such a critical channel that yields more realistic measurements of income distribution.

APPENDICES

Appendix I: Description of the Names Used in the Flowcharts

| Variable name | Description | Variable | Description |
|---------------|------------------------------------|----------|------------------------------------|
| (P)D | (price)domestic goods | GD | Government demand |
| (P)DINTM | (price)domestic intermediate goods | GDP | GDP |
| (P)E | (price)export | ID | Investment in real term |
| (P)FINTM | (price)foreign intermediate goods | INC | Total Income |
| (P)INTM | (price)intermediate goods | INVEST | Investment |
| (P)M | (price)import | ITRAN | Income transfers |
| (P)Q | (price)supply | K | Capital |
| (P)VA | (price)value added | L | Labor |
| (P)X | (price)output | MD | Money demand |
| AVGRN | Average interest rate or return | PINDEX | Price index |
| CA | Capital account | PL | Poverty line |
| CD | Consumption by households | RGDP | Real GDP |
| EXP | Expenditure | SAV(fr) | Foreign saving in raphia |
| FIN ASSETS | Financial assets | SAVING | Saving |
| FIN LIABS | Financial liabilities | WEALTH | Saving |
| FIXAS | Physical investment | WF | Wage |
| FSAV | Foreign saving in dollar | YF | Factor income |
| | | YFROW | Factor income of rest of the world |

Appendix II: Closure

| CGE | FCGE |
|-----|--|
| | Fixing irrelevant GTRAN values (=0) |
| | $GTRAN.FX(in,fr) = GTRAN.l(in,fr) ;$ |
| | $GTRAN.FX(ngi,din) = GTRAN.l(ngi,din) ;$ |
| | $GTRAN.FX(fr,din) = GTRAN0(fr,din) ;$ |
| | Other Transfers being Exogenous |
| | $OTRAN.FX(in,in2) = OTRAN.L(in,in2) ;$ |
| | Income from abroad and Subsidy Exogenous |
| | $YFROW.FX(fl,fr) = YFROW.L(fl,fr) ;$ |
| | $SUB.FX(i) = SUB.L(i) ;$ |
| | Fixing MPS (HH Saving Rate) |
| | $MPS.FX(h) = MPS.L(h) ;$ |
| | $AvgRN.FX = AvgRN.L;$ |
| | Foreign exchange market closure |
| | $SAV.FX(fr) = SAV.L(fr);$ |
| | Exogenous Investment |
| | $INVES.FX(i,in) = INVES.L(i,in) ;$ |
| | $INVES.LO(i,firm) = -INF ; INVES.UP(i,firm) = +INF ;$ |
| | $lambda0.fx(i,firm)=lambda0.l(i,firm);$ |
| | Exogenous government expenditure |
| | $GD.FX(i) = GD.L(i);$ |
| | Factor market closure |
| | $FACDEM.FX(i,f)$(WFDIST0(i,f) EQ 0) = FACDEM.L(i,f) ;$ |
| | $FS.FX(FL)=FS.L(FL);$ |
| | $FS.FX(nfl) = FS.L(nfl) ;$ |
| | $WFDIST.FX(i,f) = WFDIST.L(i,f) ;$ |
| | Financial closure |
| | $AssetSLag.FX(as,in) = AssetSLag.L(as,in) ;$ |
| | $LiabSLag.FX(in,as) = LiabSLag.L(in,as) ;$ |
| | $FixASLag.FX(in) = FixASLag.L(in) ;$ |
| | $WealthLag.FX(in) = WealthLag.L(in) ;$ |

BIBILOGRAPHY

Adelman, I., and Robinson, S., 1978: “Income distribution policy in developing countries: A case study of Korea”, Published for the World Bank, Stanford University Press, Stanford, Calif

Arrow, K. J., and Hahn, F., 1971: “General Competitive Analysis”, Holden-Day, San Francisco.

Azis. I. J., 2000a: “Simulating Economy-wide Models to Capture the Transition from Financial Crisis to Social Crisis”, *The Annals of Regional Science*, Vol.34, pp251-278,

Azis, I. J., 2000b: “The Nonlinear General Equilibrium Impact of the Financial Crisis and the Downfall of Manufacturing”, *The Developing Economies*, Vol. 38, Issue 4, pages 518–546, December 2000

Azis, I. J., 2001: “Modeling Crisis Evolution and Counterfactual Policy Simulations: A Country Case Study”, ADB Institute Working Paper Series No. 23, August

Azis, I. J., 2002: “A New Approach to Modeling the Impacts of Financial Crises on Income Distribution and Poverty”, ADB Institute Working Paper Series No. 35, March

Barro, Robert J. and Grossman, Herschel I., 1976: “Money employment and inflation”, Cambridge University Press, Cambridge and New York

De Melo, J., 1999: “ CGE Models for the Analysis of Trade Policy in

Developing Countries”, Policy, World Bank Planning and Research Department Working Paper 3, Vol 1, March

Debreu, G., 1959: "Topological Methods in Cardinal Utility Theory," Cowles Foundation Discussion Papers 76, Cowles Foundation for Research in Economics, Yale University.

Decaluwe, B., and Martens, A., 1988: “CGE Modeling and Developing Economies: A Concise Empirical Survey of 73 Applications to 26 Countries, Journal of Policy Modeling , vol. 10, no. 4, pp. 529-568

Devarajan, S., Lewis, J.D., and Robinson. S., 1994: “Getting the Model Right: The General Equilibrium Approach to Adjustment Policy”, Cambridge University Press, forthcoming, Chapter 8

Dixon, P. B., and Rimmer, M.T., 2011: “You Can’t Have a CGE Recession Without Excess Capacity”, Economic Modelling, Vol. 28, pp. 602-613

Francois, J. F. and Shiells, C. R., 1994: “Modeling trade policy: Applied general equilibrium assessments of North American free trade”, Cambridge University Press, Cambridge and New York

Ginsburgh, V., and Keyzer, M., 1997: “The structure of applied general equilibrium model”, MIT Press, Cambridge Mass.

Goodhart, Charles A. E., Sunirand, P., and Tsomocos, D. P., 2004: "A model to analyse financial fragility: applications," Journal of Financial Stability, Elsevier, vol. 1(1), pages 1-30, September.

Goodhart, Charles A. E., Sunirand, P., and Tsomocos, D. P., 2004: "A Risk

Assessment Model for Banks," OFRC Working Papers Series 2004fe11, Oxford Financial Research Centre.

Gunning, J. W., and Kyzer, M. A., 1995: "Handbook of Development Economics: Chapter 35 Applied general equilibrium models for policy analysis", Vol 3, Part A, pp.2025-2107

Johansen, L., 1960: "A Multisectoral Study of Economic Growth, Contributions to Economic Analysis", Northh-Holland Publishing Company, Amsterdam

Johansen, L., 1974: "A Multisectoral Study of Economic Growth, second enlarged ed". Contributions to Economic Analysis 21', North-Holland Publishing Company, Amsterdam

John B. Taylor, 1990. "Policy Analysis With a Multicountry Model,"

Maldonado W., Tourinho O.A.F., and Valli M.,2007: "Endogenous foreign capital flow in a CGE model for Brazil: The role of the foreign reserves". Journal of Policy Modeling, v. 29, p. 259-276

Malinvaud, E., 1997: "The Theory of Unemployment Reconsidered", Basil Blackwell, Oxford

Morley, S., Piñeiro, V., and Robinson, S., 2011: "A dynamic computable general equilibrium model with working capital for Honduras" IFPRI Discussion Paper 1130. Washington, D.C. International Food Policy Research Institute (IFPRI)

NBER Working Papers 2881, National Bureau of Economic Research, Inc.

Robinson, S., 1991: "Macroeconomic, Financial Variables, and Computable

General Equilibrium Models”, World Development, Vol. 19, No.11, pp. 1509-1525.

Robinson, S., Roland-Holst, D.W. 1988: “Macroeconomic structure and computable general equilibrium models”, Journal of Policy Modeling, Vol. 10, Issue 3, Autumn, pp. 353-375

Rutherford, T., Tarr, D., and Shepotylo, O., 2005: “Poverty Effects of Russia’s WTO Accession: Modeling “Real” Households and Endogenous Productivity Effects”, Policy Research Working Paper Series 3473, The World Bank.

Scarf, H., 1973: “The Computation of Economic Equilibria” (with collaboration of T. Hansen), Cowles Foundation Monograph No. 24. New Haven: Yale University Press

Taylor, J. B, 1983: "Union Wage Settlements during a Disinflation", American Economic Review, American Economic Association, vol. 73(5), pages 981-93, December

Taylor, L., 1990: “Structuralist CGE models. In Socially Relevant Policy Analysis”, MIT Press, Cambridge, Mass., USA

Thisen, J., 2001: “The Treatment of Financial Variables in Social Accounting Matrix-Based Short-Term Forecasting Models, Africa Development of Social Science Research in Africa, Vol. XXVI, Nos. 3&4, pp. 183-218

Thissen, M., 1999: Financial CGE models Two decades of Research, Groningen : SOM Graduate School/Research Institute Systems, Organizations and Management

Thissen, M.,1998: “Two decades of CGE modelling lessons from models for Egypt”, Groningen Graduate School/Research Institute Systems, Organisations and

Management.

Tobin, J., 1967: "A General Equilibrium Approach To Monetary Theory",
Journal of Money, Credit and Banking, Vol.1, No1, Feb, pp15-29

Torbecke, E., 1991: "Adjustment, Growth and Income Distribution in
Indonesia", World Development, Vol. 19, No.11, pp.1595-1614

CHAPTER 2

BANK-LED INFLOWS AND THEIR WELFARE IMPACTS: AN ANALYSIS OF RURAL-URBAN INCOME INEQUALITY USING A FCGE MODEL

2.1. Introduction

With growing concern among the researchers and policy makers about the increasing inequality between rich and poor, a considerable amount of policy interest has sprung up as well. In emerging and developing countries where such income inequality has already widened, and where economic activities are becoming increasingly concentrated within urban areas, this inequality is often accompanied by additional disparities in income, jobs or general standard of living. With globalization, where the financial sector has played an increasingly important role in the economy, income and regional disparities tend to be even wider. In addition to the fact that the liberalized system makes the economy more vulnerable to a crisis, such widened disparities can also potentially hinder economic and social development (Stiglitz, 2013). A case in point is the Asian Financial Crisis in 1997, where the fast-growing economy suddenly fell into a deep recession (a boom and bust cycle), causing unemployment and poverty to soar. The global financial crisis in 2008 serves as yet another example. Having originated in the US financial sector, in the subprime mortgage market in particular, the crisis quickly spread to the real sector of the economy, affecting trade, banking, and the labor market. This can also be observed in the Euro Zone crisis in 2012; the resulting recession widened the disparity of income and other social development indicators. More importantly, though, such

repercussions go worldwide, impacting many other developing and emerging economies. As a result, income disparity and the urban-rural gap also widen in emerging countries. Furthermore, the impact of the negative shock is often exacerbated given the interplay between the financial sector and the real sector along with the development of financial instruments. In reality, the shock can affect the economy and social indicators more than originally expected (amplification effect).

Observing several financial crises in developed and developing countries alike, one cannot help but wonder whether something is wrong or missing in our understanding of the role and influence of the financial sector on real sector variables. One emerging idea in the new monetary theory is the role of the *credit channel mechanism* that augments the effect on the standard transmission of monetary policy (Stiglitz and Greenwald, 2003). Thus, if the standard theory predicts that a particular policy or/and a external shock will have a negative effect by a certain amount, then the credit channel hypothesis argues that such amount will be amplified. At the extreme, a crisis can be the outcome of the policy or/and shock. One of the reasons is that the credit channel mechanism treats the role of agency cost and the availability of credit explicitly, such that the level of credit cannot be explained simply by the movement in the interest rates or by the size of loanable funds.

The credit channel involves two types of mechanism: a balance sheet channel and a bank-lending channel (Bernanke and Gertler, 1995). The balance sheet channel focuses on the impact of monetary policy or shocks on credit through changes in borrowers' balance sheet positions, whereas the bank-lending channel identifies the

impact of monetary policy or shocks on credit through changes in banks' loanable funds. The effect of any policy or/and shock can work through a credit channel, causing changes in firms' and households' balance sheet and bank-lending practices. In this respect, the effect of a policy or/and shock can be distortionary, especially during a crisis. In the interrelations between the financial sector and the real sector, the distortionary results can have a negative impact not only on the aggregate macroeconomic variables but also on income and spatial disparity.

Many studies that attempt to test the presence of a credit channel often treat the channel as an independent variable; yet, credit does not drive the economic impact of monetary policy or any shock – it is endogenously determined by the economic impacts. Thus, there is a complex two-way interaction between credit and economic condition. Based on the Indonesian FCGE model developed by Azis (2008), its updated version used in this study seeks to take into account such a complex interaction and to validate the credit channel mechanism by treating banks' credit endogenously in a dynamic context. It also expands the crucial financial mechanism by making the connection between the financial sector and social development indicators more explicit, e.g., income distribution and rural-urban disparity. The FCGE model is to be simulated under bank-led capital inflows and outflows, as these scenarios are currently happening in many emerging market economies. Based on these simulation results, we discuss how dynamics of the bank-led inflows and outflows, and activities in the financial sector under the dynamic credit channel, eventually affect the poverty and income disparity between poor and rich, and between rural and urban regions.

2.2. Theoretical Framework

In ‘Towards a New Paradigm in Monetary Economics’, Stiglitz and Greenwald (2004) highlight the critical role of the credit channel in an economy and the importance of a dynamic mechanism by which the behaviors of economic agents affect the credit availability and economy. They point out flaws in the traditional monetary economics and show how monetary and financial regulatory policy can be distortionary when it involves credit constraints. They especially emphasize the role of the banks that issue terms of credits, which in turn affect the investment decisions made by private sectors (Figure 2.1). They also argue that banks’ willingness to supply credits depends on the banks’ asset value, net worth and asset composition – all of which are endogenous, as they are affected by the dynamic interplay of newly created asymmetric information, risk, and uncertainty. Banks and firms are assumed to act in a risk-averse or risk-taking manner depending on the circumstances created by a given shock.

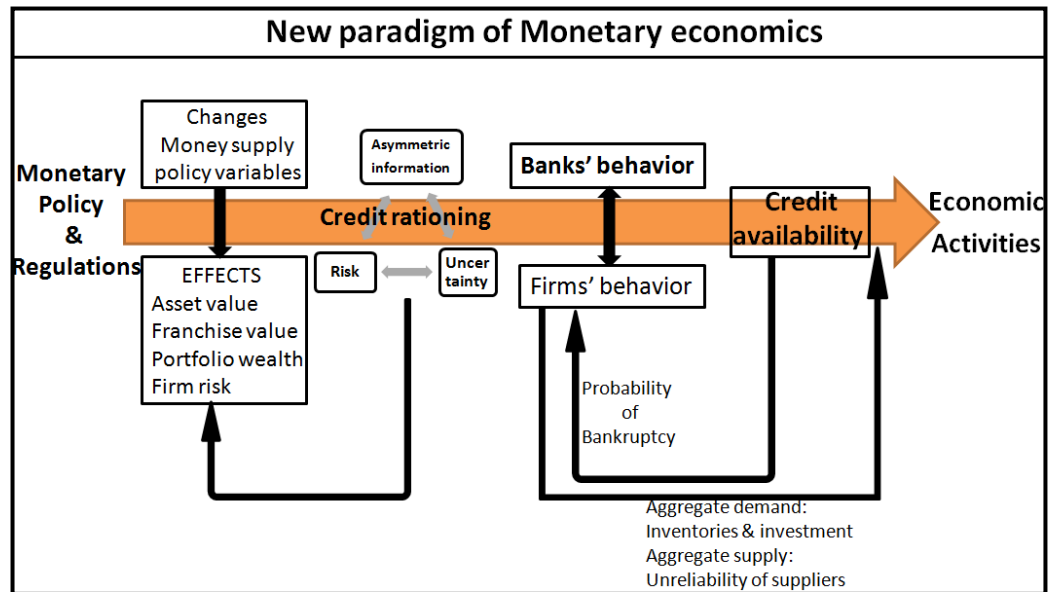


Figure 2.1. Framework of Credit Channel Mechanism

The shock changes the behavior of the agents – i.e., the banks and firms – through which the shock alters other micro and macro economic indicators, in particular, asset composition and net worth of the banks and firms. This changed behavior – risk-averse or risk-taking – with new information will in turn decide the level of loan in the economy. Finally, the level of loan availability decides the level of economic growth, which later affects the asset composition and net worth of the agents. This series of changes form a new economic status by changing banks' behavior. At this point, it forms a cycle – i.e., a vicious cycle. To deal with risk-averse or risk-taking agents in this dynamic context, the impacts of policies and any shock could be even more intensified and distortionary, especially during a recession or financial crisis. Furthermore, since in reality the decision to extend credit is based on

information that is specific and local, thus immobile.¹² Information about the borrowers is not general but applied only to them. For example, when Samsung electronics asks a bank to borrow some money, the bank has to decide how much of their funds the firm deserves to borrow and at which interest rate. Based on the net worth – quantitative and value-qualitative – of the firm, the bank judges the value of Samsung Electronics to decide the amount of loan and interest rate. This information will not be shared with other banks and will not be applied to other firms. The bank will prefer those firms that have more information available, such as a big firm, in terms of giving credits. Because extending the loan is based on the specific information (the more information available, the better), small firms are often discriminated against when seeking to borrow money from banks. In poor regions where credit is generally limited, borrowers lack immediate access to funds from banks, especially banks in other regions that have no specific information about the borrowers. When banks become stingy in extending loans for whatever reason, those poor regions suffer from a credit crunch and their balance sheet deteriorates. If the credit allocation and investment decisions are made mainly by national banks, then the effect is even more severe. Since national banks and foreign firms have limited information about local conditions of the region, they tend to allocate capital to firms and households in regions where they are familiar. This tends to exacerbate the spatial disparity.

Empirical studies by both Borensztein and Lee (2002), and by Kim (1998), show the important role of the credit channel mechanism as a key monetary

¹² In perfect information theory, it is assumed that capital is more mobile between regions

transmission mechanism in the post-crisis of South Korea. While Kim focuses on finding the characteristics of the credit channel and its practical effect, Borensztein and Lee further analyze the impact of the channel on entrepreneurs and its implications for the economy. In accordance with Kim's finding that a substantial excess demand for bank loans is caused by a sharp loan decline, which in turn is driven mostly by a pervasive and stringent rule on bank capitalization, Borensztein and Lee suggest that a credit crunch can lessen the inequality of loan distribution between *chaebol* (conglomerates) and small to medium-sized entrepreneurs (SMEs) in the post-crisis period, during which time profitability becomes a critical criterion for banks to determine the amount of credit to be allocated. Despite the reduced inequality, however, Borensztein and Lee also stress that the impact of credit decline on SMEs could be more severe than on *chaebol* firms due to access constraints that are higher for SMEs, especially in a country like Korea where *chaebols* are given an advantageous position in terms of access to credit.

Chida and Tamegawa (2004) argue that credit friction has played a pivotal role in explaining the volatility of the Japanese economy since the 1990s. As they incorporate shocks of nominal interest rates and agency costs into their dynamic general equilibrium model, they find that wealth level determines the effectiveness of monetary policy.

Azis (2004) argues that credit market frictions have played an important role in the seemingly disconnected monetary and investment growth in Indonesia, reducing the effectiveness of any policy. By incorporating balance sheet effects, monopolistic

than labor. Thus, capital flows from capital-abundant to capital-deprived regions.

competition and credit availability into financial computable general equilibrium (FCGE), Azis not only analyzes the importance of credit allocation but also demonstrates the role of integrated flow of fund (FOF) and social accounting matrix (SAM) data for capturing a more complete and better linkage among financial sector, real sector, income distribution and poverty.

2.2.1. Traditional Theory of Monetary Transmission Mechanism

To explain the transmission mechanism in the real sector by the cost of capital or interest rate, the standard monetary transmission theory focuses on demand for credit as the channel. In the traditional theory, the effect of tightening monetary policy on the components of GDP involves the following mechanism: when a tightening of monetary policy is anticipated, real GDP and price decrease. The final demand decreases, and a decline in production will follow, as will an inventory decline. This will lower consumer spending, and eventually fixed investment as well. The effect of monetary policy is transmitted through the demand for credit by the following alternative mechanisms: (1) flexible prices, as the expectation of inflation changes the opportunity cost of holding money, and (2) sticky prices. It is difficult to explain the actual monetary mechanism that affects the real economy when one uses a standard model of credit that depends solely on interest rates. Even the interest-sensitive components of aggregate demand are, in reality, only weakly affected by the policy shock. The opposite scenario where the interest rate is close to zero was not successful in boosting real sector investment during GFC in the United States. Thus, other factors must have played a role in explaining the mechanisms through which the shock affects

actual credit allocation, the real sector, and social indicators.

Bernanke and Gertler (1995) point out the failure of traditional monetary theory to explain the transmission mechanism of the conventional interest rate effects. Their conclusions are based on the following arguments: (1) monetary policy is intended for a short-term effect by which the central bank's rate is the overnight rate. Although the policy should have a weaker effect on real long-term rates, the monetary policy apparently has large impacts on long-lived asset purchases. Also, after the interest rates turn to normal track, other components of spending still do not respond to the policy change (i.e., fixed investment). (2) Although monetary policy itself is expected to have powerful effects on the real sector, the interest rate alone may have no strong effect on various components of spending. In addition, the experiences of a series of crises, especially in the last two decades or so, may have taught us the lesson that the standard theory of monetary transmission mechanism (i.e., cost of capital effect) has some serious limitations if not flaws when it comes to explaining what has been happening in the real world. Thus, the model with only this traditional monetary transmission theory would be incapable of explaining what is going on in the world. Even with FED's policy – i.e., the interest rate was almost zero – the investment was not revived after GFC.

2.2.2. The Credit Channel Theory of Monetary Transmission

The credit channel theory fills the gap between traditional monetary theory and the actual allocation of banks' credit. The credit channel involves two types of mechanism: a balance sheet channel and a banking-lending channel (Bernanke and

Gertler, 1995). The balance sheet channel focuses on the impact of monetary policy on credit through changes in borrowers' balance sheet positions. The banking-lending channel, on the other hand, explains the impact of monetary policy on credit through the changes in banks' loanable funds. Depending on the behaviors of borrowers and lenders, thus, the policy effect might be distortionary. Unlike the assumption used in neo-classical theory (i.e., perfect credit information), the presence of asymmetric information in the credit channel theory creates borrowers' opportunity costs between internal financing and external financing. Thus, changes in balance sheet channel affect the cost of external finance and the opportunity cost of internal finance. In a tight monetary policy, firms that usually have a heavy short-term debt on their balance sheet will suffer from rising debt burden. Also, their asset prices decrease as the collateral value declines due to the high cost of capital. In addition, the increased interest rates indirectly reduce firms' revenue, which will eventually affect consumer spending adversely. The short-cash flow can be compromised by the borrowing if firms still have free access to credit markets; however, since the tightening of monetary policy often weakens the sources of internal finance and decreases the net worth of borrowers, this will increase the borrowing costs while at the same time increasing the need for external financing (Bernanke and Gertler, 1995). SMEs are more limited in terms of their access to credit. In a credit crunch situation, they suffer more from the squeeze than do large firms. Furthermore, in a monetary tightening, banks also suffer from the high cost of capital (i.e., drop in the value of securities), resulting in a weaker balance sheet. Thus, given the banks' weak financial structure and a decrease in borrowers' credit worthiness, the policy effect of monetary

tightening is intensified, resulting in a sharp fall of credits, sharper than the fall predicted by a standard monetary model that relies only on the effect of interest rate changes. Banks' access to loanable funds is usually reduced, and the actual supply of credit significantly declines (Figure 2.2).

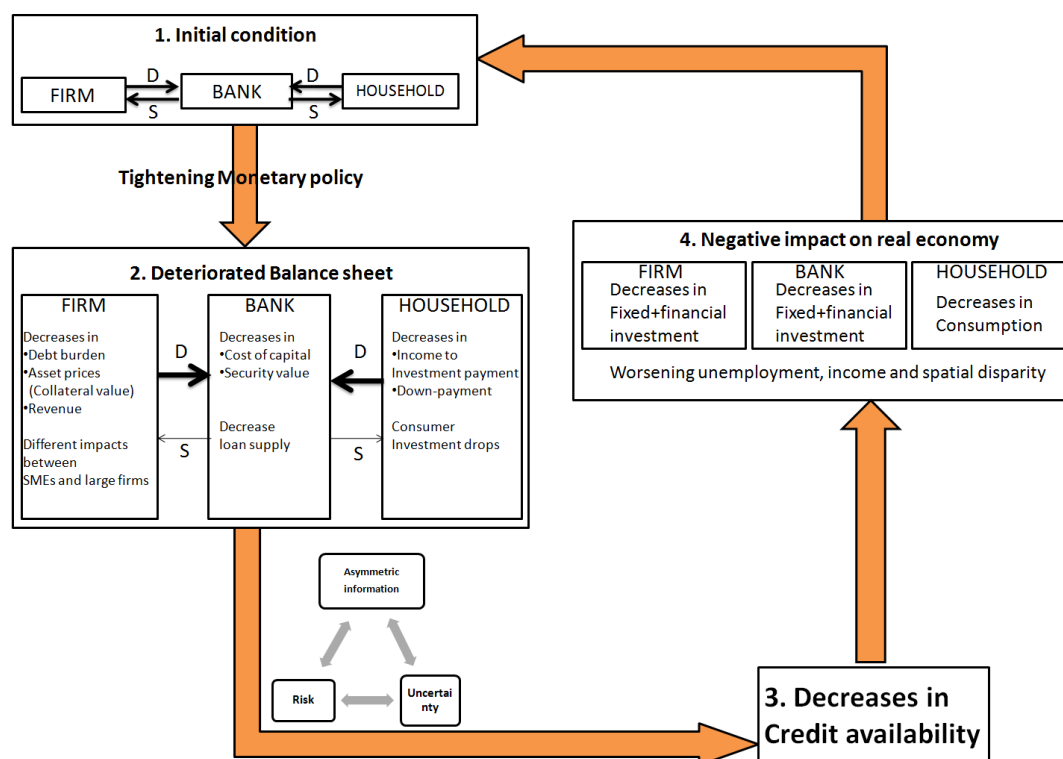


Figure 2.2. Impact of A Tightening Monetary Policy with A Dynamic Credit Channel Mechanism

In addition, the negative effect of the tightening policy can even be prolonged by decreases in household and consumer expenditures. Decreased income-to-interest-payment ratio and increased down payments impair the balance sheets of households.

Boldin (1994) also argued that mortgage burden is transmitted into a decrease in housing demand, which in turn affects households' ability to access banks' credit. In credit channel theory, the assumption of imperfect information along with the explicit treatment of risk and uncertainty are critical in explaining the behaviors of borrowers and lenders. While the balance sheet channel (i.e., borrowers) and banking-lending channel (i.e., lenders) play important roles in determining credit availability during a normal period of the economic cycle, they will be even more relevant during a crisis.

When the monetary policy changes the balance sheet position (through changes in real wealth and cash flow), information about the new balance sheet position can cause additional costs for lenders. The asymmetry of the information magnifies the risk factors and uncertainties, resulting in higher lending costs (i.e., screening borrowers' portfolios). Thus, the contractionary effect of the policy is easily magnified, thereby increasing the possibility of a recession. The increased lending cost and the increased cost of borrowers' internal financing compel banks to lower the supply of loans while borrowers increase the demand for loans. This prevents the interest rates from functioning as an equilibrating factor as specified in neo-classical theory. Instead, banks set the loan interest rates at the banks' optimal level where they maximize returns yet at rates that should not lead to the problems of 'adverse selection,' where high risk-taking borrowers are those who can afford to and who actually do borrow at very high interest rates. In effect, banks will do credit rationing. In this context, the supply of loans becomes more important than the demand. Increased risks and uncertainties associated with asset values and bankruptcy will induce lenders to allocate their portfolio more to safe assets by reducing risky lending

(i.e., substitution effect). It is also important to note that the lenders' ability to issue a loan may become secondary to their willingness to do so. Even if banks have ample liquidity (i.e., loanable funds), they may be unwilling to lend due to the high risks involved. Thus, the shock that increases asymmetric information with risks and uncertainty is likely to decrease the loan supply given the specific characteristics of credit. The overall effect on the economy can be significant because the falling amount of credit extended by one lender may not be fully offset by increased lending from others. A similar effect can be created by regulations (i.e., a non-monetary policy *per se*). For example, regulators' excessive reliance on the Capital Adequacy Requirement (CAR) can increase lenders' incentives not to lend, and they may instead prefer to invest in safe assets, such as government bonds, to compensate for the high cost of capital. The impacts of monetary policy and regulations during a crisis can be even more intensified and distortionary given the presence of the credit channel. When the crisis arrived, typical policy advice suggested by the international organization like the IMF was to raise the interest rates. When weakness in the banking sector was considered the most important source of vulnerability and crisis, like what happened during the Asian Financial Crisis in 2007, policymakers were advised to strengthen the banking sector by raising the CAR. As described above, though, both policies can yield counterproductive impacts on the already negative economic conditions. Worsening aggregate economic conditions will harm social welfare, widening the income and spatial disparity as well. This worsening social condition can, in turn, further damage the economic prospect.

2.2.3. Bank-led Inflows

Furthermore, the effect explained above can be created under the phenomenon of capital inflow intermediated through banking sector. During this financial boom, the banking sector can be inclined to invest in other profitable financial assets instead of extending a loan that might be less profitable. This behavior of the banking sector has a variety of repercussions in the economy, ranging from increased vulnerability to a widening of income inequality. Tong and Wei (2009) argued that what mattered to manufacturing firms in terms of the level of credit crunch during the global financial crisis (GFC) was not the volume of international capital flows but their composition. Azis (2013) and Forbes and Warnock (2012) examine the composition of capital flows in more detail by classifying the trend and type of capital flows that are more relevant to the recent development in emerging market economies. First, the trend of flows was divided into four types: surges and stops, when there is a sharp increase or decrease in inflows, respectively; and flight and retrenchment, when there is a sharp increase or decrease in gross outflows, respectively. Then, the flows are broken down into three types: (1) equities, which consist of direct investment and equity portfolios; (2) debts, which consist of debt securities and others including derivatives; and (3) banks, which have inflows coming through the banking sector. Flows are considered as equities-led, debt-led, or bank-led depending if the increase in inflows is mainly through equities, debt, or bank, respectively. This analysis focuses on bank-led flows since these are the fastest-growing flows in recent years, especially after the GFC, and the most volatile (Azis, 2013).

The FCGE model is simulated with the shock applied to the financial sector yet

affecting the real sector economy, in order to show the real and financial sector transmission mechanism. Also, based on the theoretical framework explained earlier, this chapter reflects what is going on right now in emerging markets in the midst of easy money policy in the developed countries: i.e., capital inflows to emerging countries. The relatively favorable interest rates and expected returns in these countries have attracted EU and US investors. Capital inflows can be beneficial to the recipient countries with limited financial investment options since they can provide more liquidity and investment opportunities to develop the financial sector. Investors can take advantage of a developed financial sector that allows them to have more options or greater access to finance. Also, the influx of foreign capital allows domestic investors to enjoy higher returns on their financial assets. A variety of financing sources and positive income effect boost investment and consumption. Under the current environment where the world's financial and real sector are highly interconnected, the foreign capital invested in the financial sector may take the form of short-term securities that can potentially affect the real sector too; however, short-term portfolio investment can also create costs and risks, causing vulnerability and even crisis in the recipient countries. Capital inflow causes foreign currency supply to rise, pushing its price lower and its local currency to become more expensive (appreciate). For emerging economies that rely heavily on export, appreciation of the exchange rate can lead to a trade account deficit, but the effect of capital inflows goes beyond just making the exchange rate stronger. When intermediated by banks (i.e., 'bank-led flows'), the recipient banks may extend credits more than normal and create credit bubbles as the funds they use are relatively cheap. This can lead to a crisis when

eventually the bubble bursts. Alternatively, instead of extending loans, banks can go into risky investments given the higher financial returns. This can create an asset bubble, making the banking sector and the entire economy vulnerable. The case in point is what happened in 2012 when most of the EU banks had to withdraw their funds from operations abroad, including Asia. This is part of the deleveraging process related to the Euro zone crisis. As a result, the volatility of capital flows in Asia have increased. One worrisome scenario is that, if the process of deleveraging continues, banks will cut a lot of credit, which could potentially lead to a credit crunch. If, on the other hand, most of the inflows are used by banks to invest in highly risky financial assets, that would increase the vulnerability of the banking sector (i.e., falling capital adequacy ratio), thereby causing a banking crisis and eventually an economic crisis. Hence, the impact of debt-led inflows can be negative.

When the interactions of various factors as a result of bank-led inflows and outflows are transmitted through the behavior of banks and firms, the consequence of the dynamic interactions in the economy are often difficult to anticipate. Therefore, the effect of the flows will be evaluated through the credit channel theory of monetary transmission explicitly and implicitly by incorporating a dynamic credit channel into the FCGE model. When the banking sector is expanding its operations, as reflected in the increased size of its balance sheet, the financial sector usually grows as well. While this contributes positively to the economic growth, only a certain segment of society that has access and therefore can benefit from the financial sector will enjoy wealth and increased income. Depending on the breadth of the impact of any shock in the economy, including shock emanating from capital inflows, the income distribution

is likely to worsen.

Although some studies using CGE models have investigated the positive and negative effects of capital flows, to the best of my knowledge, none has been able to show explicitly the mechanism by which interaction between the financial and the real sector takes into account the role of a dynamic credit channel. Also, most studies neglect to delineate the effect of bank-led inflows and outflows on social indicators such as poverty and regional income disparities. This study attempts to fill these gaps. In addition to explaining how bank-led inflows and outflows raise volatility and how such volatility is exacerbated, the analysis can also shed some light on the impacts of bank-led inflows on poverty and income inequality.

2.3. Methodology

In this chapter, the existing FCGE model used in Chapter 1 is updated to explicitly incorporate bank-led capital inflow and dynamic behavior of the banking sector. First, a new set of equations is added to incorporate the credit channel, and to make the model operate in a recursive dynamic way by applying the equation of motion where the depreciation value of capital stock in the current period affects the level of capital stock in the next period. Second, we specify the shock that we will impose on the model to explicitly reflect the recent phenomenon of capital flows that are specifically intermediated through the banking sector (bank-led flows). This process begins by specifying the capital flow channel that indirectly affected banks' financial structure through FSAV in the previous chapter: foreign capital flows go into

the banking sector and, depending on banks' behavior, subsequently affect the economy. Thus, bank-led flows in this chapter directly increase the liability side of a bank's balance sheet as well as foreign saving in the FCGE model specification. Third, we modify the existing credit channel equation in Azis (2004) by allowing it to operate under dynamic simulation. The credit channel equation is modified to take into account the dynamic characteristic of banks in making decisions about extending loans to firms. When the exchange rate appreciates due to capital inflows, the relative value of the assets of firms and banks improve, affecting favorably the banks' decisions to extend loans; however, this decision can only be made in the next period since there is a time lag for applying the new financial structure of borrowers and banks themselves in the decision. The impact on banks through the financial structure of borrowers will be disclosed only in the next period. Under this dynamic credit channel specification, the financial structures of borrowers and lenders are multiplied by the ratio of the initial exchange rate to the change in exchange rate that is due to the shock. The changes in the financial structure of firms along with financial structure of banks thereby determine the level of loan that will be available in the next period. Such important channels and transmission mechanisms tend to be overlooked by most analysts. Consequently, the policy response or the impacts of capital flow through the financial sector can be worse than expected.

In summary, the following features distinguish this chapter from the previous one: (1) here, we activate the equation of motion to represent the recursive dynamic nature of the simulation – Equation of motion; (2) the nature of the shock focuses specifically on bank-led inflow (CFLOW) rather than overall inflow through the

increase in foreign saving (FSAV) as done in the previous chapter – Bank-led inflow channel; and (3) finally we include the exchange rate effect in the credit channel equation-dynamic credit channel – Dynamic credit channel. These features are reflected in the interactions among all real and financial sector variables, as well as income inequality and poverty line, given a shock of bank-led flows.

2.3.1. Equation of Motion

The FCGE model in the previous chapter was static, measuring the steady-state outcome from controlled changes. In this chapter, I employ a dynamic FCGE model, explicitly tracing the cumulative impact on each variable given the dynamics in the economy. Such a model takes into account the changes over time by allowing capital to be adjusted (i.e., equation of motion). Even without a shock or any policy changes, capital stock will keep changing as a result of the economic process and capital depreciation. Thus, the amount of capital stock this year differs from the capital stock of the previous year. The capital stock in the model is depreciated by δ . The capital stock next year represents this year's capital stock after depreciation plus new capital generated by some investment activities. Thus, the equation of motion is as follows:

$$K_{t+1} = K_t(1 - \delta) + I_t \quad (\text{Eq. 1})$$

where K is capital, t is the corresponding time, δ is the depreciation factor, and I is the new stock created. This is expressed in the FCGE model as follows:

$$KSTOCK_f\$ (years(t)ge 2) = (1 - DEPREC) * FS_{fact2} + 0.1 * sum(i, DK_i) \quad (\text{Eq. 2})$$

$$FS.FX_{fact2} \$ (years(t)ge 2) = KSTOCK \quad (\text{Eq. 3})$$

$$FS_f = \text{sum}(i, FACDEM_{i,f}) \quad (\text{Eq. 4})$$

$$VA_i = avx_i * av_i * (\sum_f bv_{i,f} * FACDEM_{i,f}^{-\rho_{hov_i}})^{-1/\rho_{hov_i}} \quad (\text{Eq. 5})$$

Capital stock in the next period ($KSTOCK_f(\text{years}(t)ge 2)$) is capital supply in the previous period after its depreciation (DEPREC), and new stock created (DK). The new capital stock (K_{t+1}) will be reflected as an input in the following year's value added. The latter will in turn determine the level of output. The results from the recursive-dynamic model can be interpreted as a representation of the future economy irrespective of whether or not there are some external shocks or policy changes. The specified FCGE model, therefore, offers more flexibility to handle a wide range of issues in order to capture the impact of the external shocks that are mediated through relative prices and market forces. In this sense, the dynamic model is more useful than the static model when estimating the effect of changes in one part of the economy upon the rest.

2.3.2. Bank-led Inflow Channel

This specification reflects increased foreign capital flowing into the economy through the banking sector. The banking sector receives the foreign capital in the liability side of the bank's balance sheet while the economy accounts for this as foreign savings, thereby increasing the bank's liability and total saving in the economy. The bank-led inflows (CFLOW(bank)) are added to the existing foreign saving (SAV_{fr}) equation by subtracting CFLOW from SAV_{fr} because foreign saving itself is a negative value (see equation below).

$$\begin{aligned}
SAV_{fr} = & ggshr_{gin} \sum_f (factorin_{fr,f} * YF_f) + \sum_{in2} ITRAN_{fr,in2} + mrshr_{fr} * \sum_i (PWM_i * \\
& EXR * M_i) - (ershr_{fr} * \sum_i (PWE_i * EXR * E_i) + \sum_f YFROW_{f,fr} + \sum_{in} ITRAN_{in,fr}) - \\
& \sum_{bank} CFLOW_{bank}
\end{aligned} \tag{Eq. 6}$$

CFLOW into the emerging country occurs through the banking sector as a form of financial liability. In the FCGE model, this means the bank's total liability must include CFLOW:

$$\sum_{as} Liab_{bank,as} = \sum_{as} Liab_{bank,as} + CFLOW_{bank} \tag{Eq. 7}$$

While the FCGE model in the previous chapter illustrates how capital inflows indirectly affect the banking sector and other sectors through an increase in foreign saving (FSAV), this CFLOW channel illustrates more specifically capital inflows intermediated through the banking sector. The impact of the two capital inflows will differ.

2.3.3. Dynamic Credit Channel

This channel now can illustrate a dynamic characteristic of banks in their making of decisions to extend loans to firms. The exchange rate appreciation due to capital inflows affects the decision given changes in the banks' and borrower's balance sheet positions. When a firm and bank have ample amounts of assets in local currency, the exchange rate appreciation will improve their financial structure; however, this decision can only be made in the next period since there is a lag for applying the new financial structure of borrowers and banks themselves. This is also

explicitly expressed through the credit channel equation in the dynamic FCGE.

Bank's loanable funds are the funds available for lending; however, availability does not necessarily imply that loans will actually be extended. According to the credit channel hypothesis, not all loanable funds will be made into loans; it depends on the balance sheet positions of lenders and borrowers. The financial structure of these agents determines how much banks are willing to lend. If the bank decides to issue 50% of loanable funds as loans to firms, and also purchases government bonds with the rest of their loanable funds, then only 50% will be available as actual credit in the economy. The more a bank tries to possess safe assets such as government bonds, the less loans will be available in the market. During an economic downturn, banks tend to become more risk-averse. In a booming economy, on the other hand, bank's behavior becomes more risk-taking, purchasing risky assets such as short-term securities. Either way, the economy ends up with reduced availability of funds for credit. Thus, banks' decision whether or not to extend loans matters. In fact, this decision depends on the balance sheet position of the lenders themselves as well as the borrowers. Banks are reluctant to lend their funds to firms whose balance sheet is weak, no matter how ample the bank's available funds. This is related to the bank's perception of the low probability of repayment.

The balance sheet position (i.e., financial structure) of firms depends on the exchange rate as well. Firms with abundant local currency-denominated assets will perceive the appreciation of exchange rate positively. In the model, we specify the impact of the exchange rate in a dynamic manner such that the new balance sheet position, which has been affected by the exchange rate, is taken into account in the

next period along with the new asset values. The same logic is applied to banks. Exchange rate appreciation will also have a positive effect on their balance sheets in the next period. Under this dynamic credit channel specification, the financial structure of borrowers and lenders is multiplied by the ratio of the initial level of the exchange rate to the exchange rate changes following the shock. These changes will thus determine the level of loan in the next period (Eq. 8).

BANKLOAN\$(years(t)ge 2)

$$\begin{aligned}
&= ss * BANKF_{bank} * \left[\frac{EXR0}{EXR} * \frac{\sum_{firm} WEALF_{firm}}{(\sum_{as,firm} Asset_{as,firm} + \sum_{firm} FixA_{firm})} \right]^{ss1} \\
&* \left[\frac{\sum_{asgb,bank} Asset_{asgb,bank}}{(\sum_{as,bank} Asset_{as,bank} + \sum_{bank} FixA_{bank})} \right]^{ss2} * \left[\frac{\sum_{assbi,bank} Asset_{assbi,bank}}{(\sum_{as,bank} Asset_{as,bank} + \sum_{bank} FixA_{bank})} \right]^{ss2} * \\
&\left[\frac{EXR0}{EXR} * \frac{\sum_{bank} WEALFF_{bank}}{(\sum_{as,bank} Asset_{as,bank} + \sum_{bank} FixA_{bank})} \right]^{ss3}
\end{aligned}$$

(Eq. 8)

$$BANKLOAN$(years(t)ge 2) = \sum_{ascr,bank} Asset_{ascr,bank} \quad (Eq. 9)$$

where ss, ss1, ss3 are positive values and ss2 is negative value. The different parameters as a result of the presence of asymmetric information represent the channels by which credit availability affects income distribution and unequal development. This behavioral equation illustrates the explicit channel by which capital flows affect institutions' behaviors.

REAL SECTOR ← **FINANCIAL SECTOR**

REAL SECTOR

FINANCIAL SECTOR

INC (Social indicator)

YFROW (Financial variable)

YF (Financial variable)

ID (Financial variable)

ITRAN (Financial variable)

GD (Financial variable)

CD (Financial variable)

RGDP (Financial variable)

GDP (Financial variable)

PINDEX (Financial variable)

EXP (Financial variable)

PL (Social indicator)

UEMPR (Social indicator)

MD (Financial variable)

AVGRN (Financial variable)

EXR (Financial variable)

TOBIN (Financial variable)

RISK (Financial variable)

FIN ASSETS (Financial variable)

FIXAS (Financial variable)

L (Financial variable)

K (Financial variable)

(P)VA (Financial variable)

INVEST (Financial variable)

SAVING (Financial variable)

WEALTH (Financial variable)

FIN LIAB (Financial variable)

RN (Financial variable)

SAV(tr) (Financial variable)

FSAV (Financial variable)

CFLOW (Financial variable)

BANKLOAN (Financial variable)

Balance sheet effect

Portfolio Allocation

To bank's liability

Distribution effect

Poverty incidence

TAX (Financial variable)

(P)E (Financial variable)

CA (Financial variable)

WF (Financial variable)

(P)J (Financial variable)

(P)X (Financial variable)

(P)Q (Financial variable)

(P)D (Financial variable)

(P)INTM (Financial variable)

(P)DINTM (Financial variable)

(P)FINTM (Financial variable)

Depreciation

TSAVING (Financial variable)

TSINVEST (Financial variable)

Quantity effect (dotted arrow)

Price effect (solid arrow)

Social indicators (shaded oval)

Financial variables (unshaded oval)

| Real Sector Variables | | | | | | Financial Sector Variables | |
|-----------------------|--------------------|----------|-------------------------------------|--------------|------------------------|----------------------------|--------------------------------------|
| INC | Income | (P)X | (Price)Domestic Output | K | Capital | ASSETS | Total Asset at the end of period |
| YCONS | Consumption | (P)Q | (Price)Domestic Supply | WF | Factor Income | FIXAS | Fixed Asset (=Invest) |
| EXP | Expenditure | (P)D | (Price)Domestic Goods | EXR | Exchange rate | WEALTH | Financial saving (=Saving) |
| RGDP | Real GDP | (P)INTM | (Price)Intermediate Inputs | PIINDEX | Price Index | LIABS | Total Liability at the end of period |
| CD | Consumption Demand | (P)DINTM | (Price)Domestic Intermediate Inputs | ITRAN | Income Transfer | RN | Financial Return |
| GD | Government Demand | (P)MINTM | (Price)Imported Intermediate Inputs | Depreciation | Capital Depreciation | AVGRN | Weighed Average Financial Return |
| ID | Investment Demand | (P)VA | (Price)Value Added | INVEST | Real Sector Investment | MD | Money Demand |
| (P)E | (Price)Export | YF | Factor Income | SAVING | Real Sector Investment | BANKLOAN | Credits issued by Banking Sector |
| (P)M | (Price)Import | YFROW | Factor Income of ROW | PL | Poverty Line | FSAV | Foreign Saving |
| CA | Current Account | L | Labor | UEMPR | Unemployment | CFLOW | Bank-led Capital Flows |

The transmission mechanism of the bank-led flows is depicted in Figure 2.3. The flow (labeled ‘CFLOW’) is one form of foreign saving (FSAV). It is part of the liabilities on the recipient's balance sheet. The bank-led inflows (CFLOW) thus will not only augment total saving of the economy but also directly increase the liability of bank, potentially raising the share of a bank's non-core liability. The growing

liabilities, especially originating in non-core sources, provide opportunities for the bank to extend loans, in which case *bankloan* is extended to firms and households. The loan extended to households is shown in the liability side of their balance sheet. The increased *bankloan* also augments the asset side of banking sector in its balance sheet. The behavior of the banks in terms of extending loans or not is affected by the balance sheet condition of the borrowers (i.e., the firms), the quality of which is captured in the model by the ratio of wealth to total assets. Bank's decision to extend loans is also determined by the balance sheet positions of the banks themselves. The indicators that are used to reflect the bank's balance sheet condition are the ratio of wealth to the total assets of the lender and borrower, and the ratio of safe assets to the total assets of the lender; the latter reflects the size of the government bonds held by the banking sector. The higher the ratio, the higher the bank's CAR. These three indicators play a role in determining the size of loan extended by the banks. Clearly, this is different from what the standard monetary economic theory suggests, i.e., that interest rate and the amount of loanable funds are the determining factors.

This core premise of credit channel theory is taken explicitly in the FCGE model. This is one of the important extensions from the FCGE model used in the previous chapter. This credit channel specification clearly highlights the importance of financial structure (balance sheet analysis) in understanding the growth and development process in many countries where the role and size of the financial sector are relatively big. More critically, this shifts the whole analysis of macro policy and micro prudential policy into a merging of the two, i.e., macro prudential policy, where the financial structure of each agent in the economy is at the center of the policy

analysis.¹³ The size of the financial assets that the economic agents have is directly associated with the financial asset price, forming a dynamic relationship between the volume and price. Given a particular shock, the asset price increase will raise the domestic asset prices. In my model, there are 14 interest-bearing financial assets, each of which has its own prices (return on financial asset-RN). Three of these assets (i.e., working capital credits, equity and share, and short-term securities) are determined endogenously in the model. Thus, an increase in bank-led inflows can inflate the asset prices. Being the weighted average of all of these financial returns, the interest rates depend on the dynamics of the financial sector. The interest rates and financial structure of agents will in turn jointly determine the level of real sector investment. While the effect of financial structure on investment works through the level of credit as described earlier, the interest rates work more directly as the rates appear in the investment equation. The real sector investment also depends on the exchange rate. Given that, in most emerging market economies, exchange rates are no longer fixed, and fluctuate according to changes in the macro condition, including capital flows, the inflows can also pose some risks (e.g., exchange rate risk). For example, if firms have foreign currency loans in the liability side of their balance sheet and for some reason the exchange rate depreciates, then the size of the loan measured in local currency will multiply, deteriorating the balance sheet of the firm. In such circumstances, firms will

¹³ Many countries in recent years have tried to link the goal of maintaining price stability and securing financial stability. In some countries, they even amended the central bank law, which typically only stresses the importance of price stability, by explicitly adding financial stability as another goal. Korea is one such example – in 2011, the Bank of Korea (central bank) amended its law by explicitly specifying the importance of achieving financial stability in addition to price stability. See Bruno, V., and Shin, H.S., 2013; and Kim, Changsoo, 2013 in Bibliography.

not invest and banks will be reluctant to issue new loans. If, on the other hand, foreign loans are in the banking sector, when the exchange rate depreciates, the bank's balance sheet will deteriorate, in which case banks will be equally reluctant to expand by extending credit. Either way, exchange rate depreciation will have a dampening effect on credit and investment. As shown in the investment equation (Eq9), the exchange rate appears on the right-hand side of the equation. On the contrary, if the exchange rate appreciates, as is usually the case when there is an increase of capital inflows, the relative position of firms' balance sheet will tend to improve. This is explicitly treated in the credit channel equation as well (Eq8). As such, the exchange rate also plays a critical role in determining the level of investment directly through the investment equation as well as indirectly through the credit channel equation. With this specification, the size of the effect of any shock tends to be amplified. The resulting level of investment feeds into the real sector through ID before eventually affecting the level of RGDP. In the process, income generation is established in which total supply (Q), total output (X) and value added (VA) interact before resulting in factor income (YF).

The feedback effect from the real sector to the financial sector is also at work. The rising income of different institutions, after tax payments, determines the level of expenditure (EXP) and real consumption (CD). The remaining portion of the income forms savings. This change in saving alters the wealth, including financial assets and price. Hence, the balance sheets of different institutions are affected.

$$INVES_{i,fin} = lambda0_{i,fin} * VA_i^{lambda1_i} * (1 + avgRN)^{lambda2_i} * EXR^{lambda3_i}$$

(Eq. 9)

Another channel from the real sector to the financial sector works through the money market. The level of money demand (MD) depends on interest rate (AvgRN) and level of income (INC). Thus, financial channels through AvgRN and the real sector channel through income jointly determine the level of money demand. In turn, MD as part of financial assets determines the volume of assets and liability (i.e., the balance sheet) of different institutions, establishing another two-way link between the real and financial sectors in the model.

An alternative way to describe the mechanism is by distinguishing between price effect and quantity effect of the bank-led flows. Increasing MD amplifies the rising volume of liability and assets due to CFLOW. Along with the direct effect of FSAV on saving and the link between MD and institutional balance sheet, this represents the quantity effect of the bank-led flows on the financial sector. In the chart, this quantitative effect is shown through the dotted arrow line. The price effect (shown by the thick solid arrow line), on the other hand, is captured through the link between the endogenously determined asset price (RN), which includes the interest rate (AvgRN) and income of different institutions (INC) and investments (INVEST). The effect of changes in the size of asset and liability on the returns of financial asset (RN) is another channel that shows the price effect. Both the quantity and price effects determine the nature and intensify of the interaction between the financial sector and the real sector in the model. In this chapter, I utilize such interactions to capture the role of the credit channel in simulating the effect of bank-led flows.

To summarize, the easy money policy in industrial countries that led to massive capital inflows to emerging market economies also led to potential capital inflows intermediated through the banking sector (bank-led flows). These flows increase the liquidity and size of the balance sheet of the banking sector and, in turn, those of firms and households. The resulting appreciated exchange rate that is due to the inflows improves the relative position of the firm's financial structure. According to the credit channel equation specified in Eq8, this will augment the firms' wealth in that banks' incentive to issue credit also increases. The way the model captures this mechanism is through a recursive dynamic manner (dynamic credit channel) in which the change in the exchange rate is incorporated into the calculation of firm's wealth, and this firm's wealth is then activated in the credit channel equation in the subsequent period (Eq8).

Incomes are generated from factor income, income transfers, and financial income – all of which determine the income distribution between poor and rich households, and the between households in rural and urban areas. In the next section, I discuss the results of model simulations by examining the economy-wide impact of bank-led flows, including impacts on income distribution and poverty.

2.4. Analysis

Five different scenarios are analyzed in this section. The first two scenarios validate two critical specifications: the credit channel and its dynamic feature. Each scenario compares the result from the models including and excluding each feature.

The third and fifth scenarios investigate the socio-economic impact of prudent and non-prudent behaviors of the banking sector under the increased bank-led inflow. The third scenario also includes the impact of the different behaviors of firms when the banking sector is involved in risky, or non-prudent, financial behavior. The fourth scenario deals with a boom and bust cycle and its implication.

2.4.1. The Comparison of Non-credit and Credit models

In order to highlight the role of credit channel in the model, this section starts by comparing the simulation results from the FCGE model without the credit channel (non-credit model), and the FCGE model with the credit channel (credit model). The equation of motion is activated and CFLOW shock is used in the two models. The result shows that the credit assets of banking sector in the credit model are less than those in the non-credit model (Table 2.1). As a result of the increased inflows, the wealth of bank and firm decrease in both models; however, when it comes to bank loans available in the economy, bank loans in the non-credit model do not change, whereas those in the credit model decrease. This shows the negative balance sheet effect on bank loans in the presence of credit channel. In other words, the credit model takes into account the fact that the availability of credit in the economy depends not only on interest rates but also on the financial structure of the lenders and borrowers. Furthermore, in the credit model, the income distribution of the households worsens (Figure 2.4). This suggests that the non-credit model underestimates the income inequality effect. The decrease in bank loans involving the credit channel mechanism can create distortion in the income distributed to the rich and poor households and to

rural and urban areas, thus worsening the income and regional disparities.

Table 2.1. Wealth and Bank's Loan in Non-credit and Credit Models

| Wealth | | | | | |
|-----------------------------|---------------|------------------------|---------------------|----------|------------|
| CFLOW shock | Baseline | Without credit channel | With credit channel | Change | |
| | | | | Absolute | % |
| Bank's Wealth | 23655738.00 | 23656945.00 | 23655359.00 | -1586.00 | -0.0067042 |
| Financial Firm's Wealth | 52103470.00 | 52104116.00 | 52103159.00 | -957.00 | -0.0018367 |
| Non-Financial Firm's Wealth | -608528100.00 | -608517400.00 | -608533200.00 | -15800.0 | -0.0025965 |
| Bank's Credit Asset | | | | | |
| CFLOW shock | Baseline | Without Credit channel | With Credit channel | Change | |
| | | | | Absolute | % |
| Bank Loan | 576144310.0 | 576144310.0 | 576138010.0 | -6300.0 | -0.0010935 |

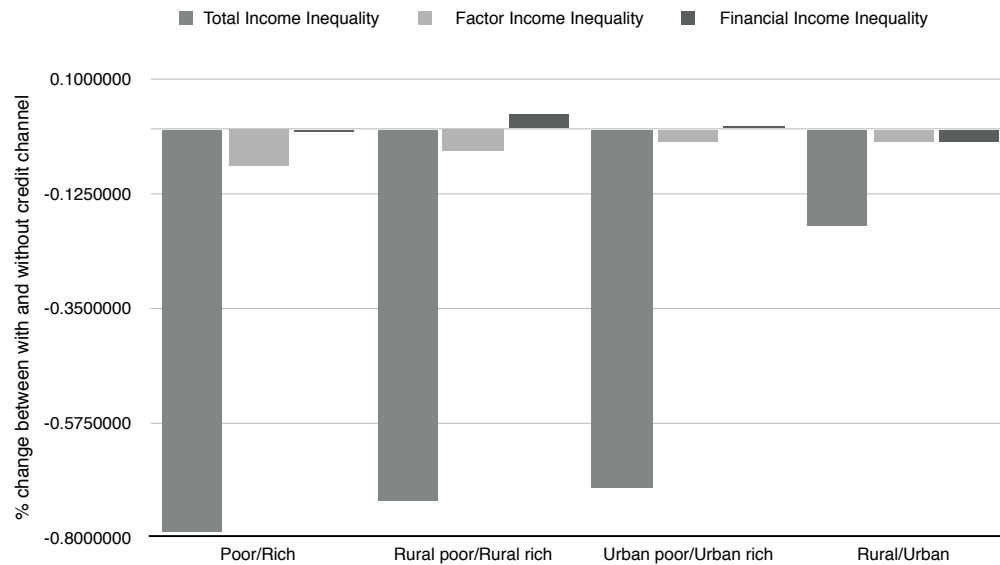


Figure 2.4. Household Income Distributions: % Changes Between Non-credit and Credit Models

2.4.2. The Dynamic Credit Channel

Table 2.2. Changes in Bank's Balance Sheet Between the Static and Dynamic Models

| Banking sector | | | |
|--------------------------|-----------|------------|--------------------------|
| Asset | | Liability | |
| Fixed investment | 30.41 | -229.00 | Wealth |
| Money demand | -15875.00 | -111070.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond |
| Short-term securities | 61490.00 | 24668.00 | Short-term securities |
| Credits | -4950.00 | -157.90 | Credits |
| Equity&share | 7602.80 | 135080.00 | Equity&share |
| Others | 0.00 | 0.00 | Others |
| | 48300.00 | 48300.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value

The dynamic credit channel model (dynamic model) reflects the role of exchange rate appreciation or depreciation in the determination of bank loans by affecting the balance sheets of borrowers and lenders. The exchange rate appreciation due to the massive capital inflow inflates asset values in domestic currency. This is favorable to the asset holders, providing better financial structure of lenders and borrowers. The banks, however, focus instead on risky investments, buying short-term securities and equity and shares while decreasing their issuing of credit (Table 2.2). This shows that banks are inclined to be more profitable by having more security and equity assets, which provides higher returns than having credit assets. According to credit channel theory, the banks are supposed to increase lending given the favorable balance sheet effect; however, banks decided to allocate their capital more to securities, and equity and share while decreasing their loans because of bank's strong

preference for the excessive risk-taking investments in the midst of increased liquidity from the capital inflow. This behavior of the banking sector supports Tobin's theory of portfolio allocation.¹⁴ This investment pattern will later make the return on such assets even more increased. Indeed, financial income of both banks and firms are further increased, increasing their total income despite the decline in factor income under the dynamic credit channel analysis. It turns out that this excessive risk-taking behavior of the banking sector further worsens the income distributions, as shown in Figure 2.6. Interestingly however by incorporating exchange rate changes in the behavior of banking sector the magnitude of the income decline of all categories of households are smaller than the case when the exchange rate does not play a role in bank's behavior. See Figure 2.5. This implies that the household income and income distributions can be overestimated if the dynamic feature is not incorporated into the analysis. For such reason, the dynamic credit channel is used to analyze the behavior of the banking sector after section 2.4.3.

¹⁴ According to Tobin, investors allocate their financial asset based on risk and the returns on financial assets. In this case, the benefit from the returns on securities and equity and shares might outweigh the risk embedded in the financial asset investment given the booming environment.

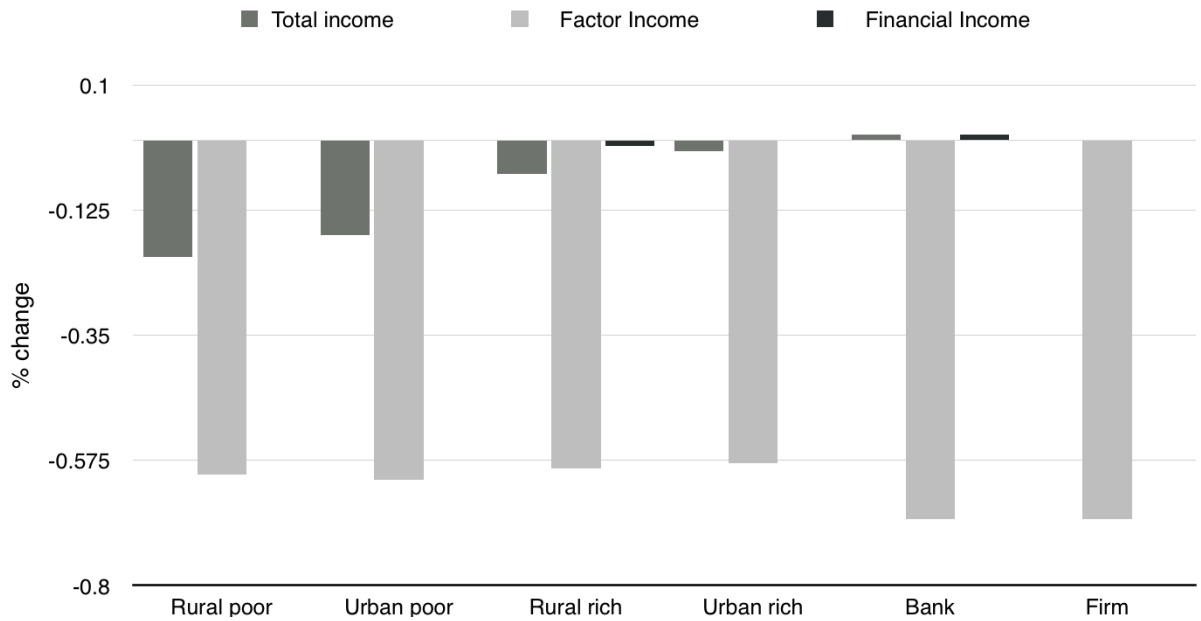


Figure 2.5. Income of Domestic Institutions: % Changes Between Static and Dynamic Models

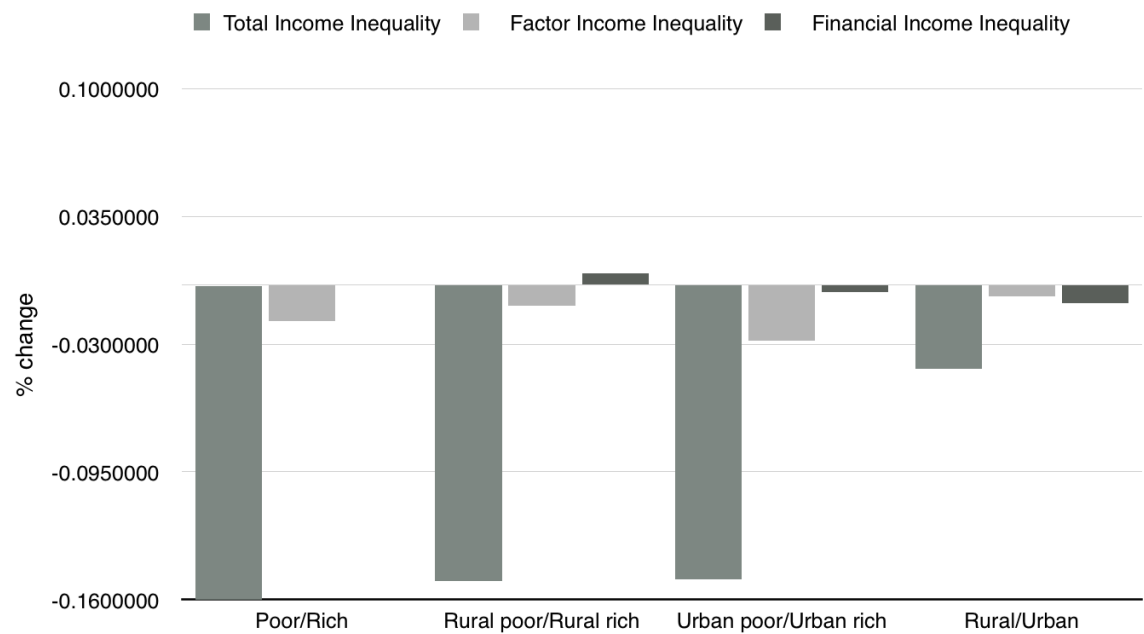


Figure 2.6. Household Income Distributions: % Changes Between Static and Dynamic Models

2.4.3. Risky Behavior of Banking Sector Under Bank-led Inflow

This scenario analyzes the impact of the non-prudent behavior of the banking sector under CFLOW rather than the banking sector playing a traditional role as an intermediary. The results are compared with the baseline.

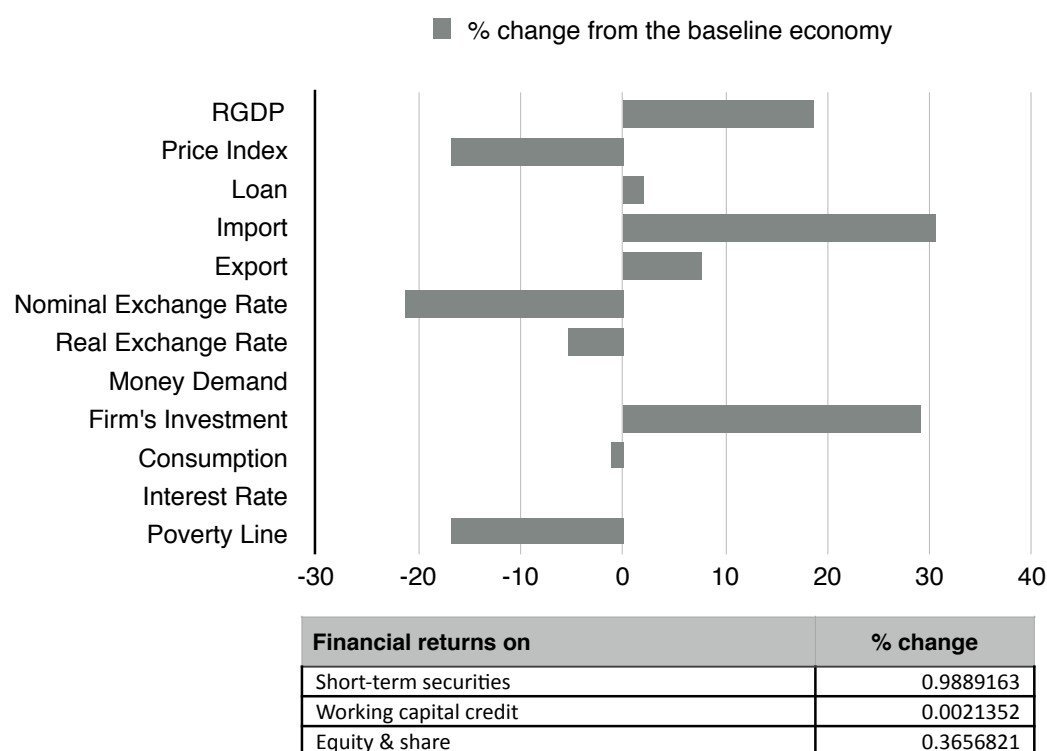


Figure 2.7. % Changes in Real Sector Variables and Financial Returns under Risk-taking Behavior

The results show that an increase in bank-led flows has an expansionary effect on the overall economy. As shown in Figure 2.7, the real GDP, investment, export, and import all increase such that the labor market is benefited as indicated by the

decline in unemployment rate. The bank-led flows that augment the balance sheet of lenders and borrowers also tend to raise the domestic financial assets. In Table 2.3, this is shown by an increase in the financial returns, short-term securities, and equity and share. The rising return of financial assets along with growing economy would have placed pressure on price level; however, the endogenously determined interest rates in the model play a role as one of the equilibrating factors. As shown in Figure 2.7, the interest rates increase, countering the inflationary pressure. The resulting appreciated EXR provides an additional countermeasure on prices such that the price level declines. Overall, therefore, the economy expanded without inflationary pressure, although export declines. The absence of inflation has created another favorable effect on poverty line measured by the quantity of basic needs multiplied by the price of those commodities; however, to determine the precise effect on poverty, one must also examine the impact on the income of the poor (Azis, 2008). As depicted in Figure 2.8, the total income of both the rural and urban poor decrease slightly; however since the percentage decline of the poverty line is greater than the percentage decline of income of the poor, it is likely that poverty incidence declines.¹⁵

¹⁵ The incidence of poverty measured as a headcount of poverty is the number of people living below the poverty line. Therefore, lower poverty line and higher income of the poor implies a lower headcount of poverty.

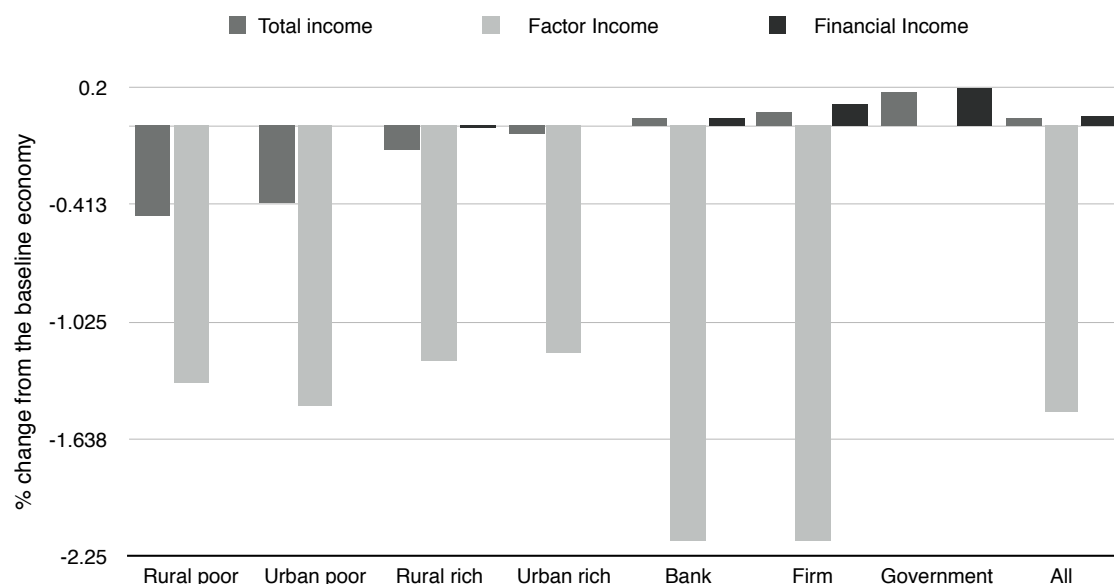


Figure 2.8. % Changes in Income of Domestic Institutions under Bank's Risk-taking Behavior

The real sector investment increases given the increased availability of bank loans. The 30% increase in investment in response to only a 3% increase in bank loans shows that the firms rely not only on banks' loans but also on other sources of financing as well. For example, borrowing agents can finance their investment through funds raised in equity, share and securities markets. This argument is supported by the increase in equity and short-term securities in firm's liability (Table 2.3). The augmented income of firms is solely due to their financial income. Despite the sharp decrease of their factor income, the total income is increased due to the earnings from the financial activities (Figure 2.8). This sector plays a critical role in total investment, and their income share among all agents is the biggest in the

economy. Thus, the booming financial sector can have a positive impact on them and the overall investment in the economy.

The consumption decrease is supported by the decrease in total income of all households. Their factor income decreases due to falling wages, and rural rich and urban poor households experience the sharpest decline in their income and consumption. Only the financial income of urban rich households is recorded to be rising (0.1%). This increase, which is due to higher financial returns supported by the capital inflows, makes the rich households less affected by the income loss.

Table 2.3. Absolute Changes in Bank's and Firm's Balance Sheets Showing Banks' Risk-taking Behavior

| Banking sector* | | | | Firm* | | | |
|--------------------------|-----------|------------|--------------------------|--------------------------|------------|------------|--------------------------|
| Asset | | Liability | | Asset | | Liability | |
| Fixed investment | 0.00 | -735.00 | Wealth | Fixed investment | 176412.05 | -10503.00 | Wealth |
| Money demand | -50986.00 | -146570.00 | Money demand | Money demand | -437242.70 | 0.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit | Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate | Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond | Government bond | 0.00 | -595108.37 | Government bond |
| Short-term securities | 180393.00 | 72367.00 | Short-term securities | Short-term securities | 8798.17 | 120288.29 | Short-term securities |
| Credits | 3080.00 | 98.10 | Credits | Credits | 109.00 | 7210.00 | Credits |
| Equity&share | 12364.10 | 219680.00 | Equity&share | Equity&share | 145692.33 | 371882.00 | Equity&share |
| Others | 0.00 | 0.00 | Others | Others | 0.00 | 0.00 | Others |
| | 144900.00 | 144900.00 | | | -106230.00 | -106230.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value during bank-led inflow from baseline

Banks in this economy, and in this analysis, play an important role especially as an intermediary; however, the results show that the banking sector plays a role more as an investor in the financial sector than as an intermediary during this inflow. In response to the increased foreign capital in their balance sheet, the banking sector

issues short-term securities, equity and shares while borrowing money (see the liability side of bank's balance sheet in Table 2.3). This behavior of the banking sector drives down the prices of those financial assets by increasing the supply in the market. This, in turn, increases the financial returns on the short-term securities, equity, and share assets. The high returns on those assets lure the investors, which include the banking sector. The banking sector increases short-term security and equity and share assets while decreasing money demand and even sacrificing their wealth. This indicates that they are involved in risky financial investments given the abundance of foreign capital. This can create volatility and even vulnerability in the economy. The capital adequacy ratio (CAR) -- capital/risky assets -- is indeed decreased.

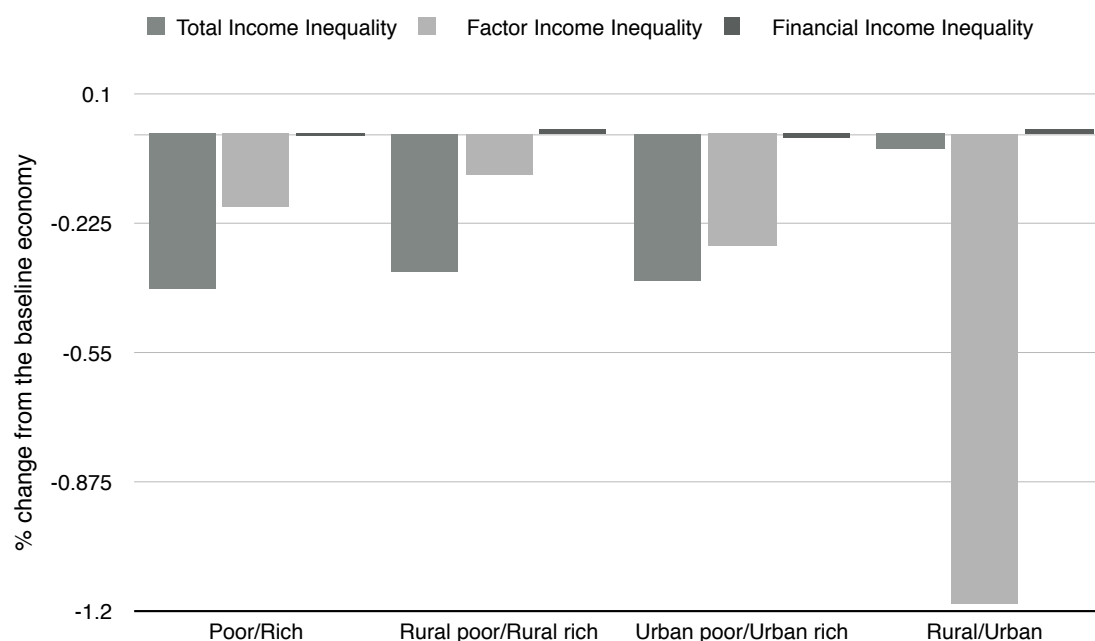


Figure 2.9. % Changes in Household Income Distributions under Bank's Risk-taking Behavior

Some might argue that this behavior of the banking sector has a minor impact on the economy based on the favorable macro-economic performance described earlier; however, what is still missing from the above analysis is the impact of the behavior of the banking sector on income inequality. As described above, there are three main sources of household income: factor income (YF), income transfer (ITRAN), and financial income (ASSETS*RN). The growing economy led to growing income of most institutions, particularly banks, non-financial firms, and government. The total income of all institutions indeed increases although incomes of the households decline. This suggests that since the bank-led flows are more connected with banks and the modern sector, the latter benefits more from the flows. In the model specification, I assume that there is no change in the income transfer between institutions. The resulting total income, however, still needs to be added to the financial income. As shown in figure 2.8, the increase in bank-led flows generates a higher increase in financial income for the rich urban households. This implies a worsening rural-urban income disparity¹⁶ (see Figure 2.9). From Figure 2.9, we can also see that the total income distribution between the poor and rich has worsened and as has distribution between rural and urban regions. Within rural areas, the factor income distribution is expected to be most dominant. Thus, the worsening of distribution in that category of income leads to the worsening of total income distribution. In the urban area, since only the urban rich have access to financial assets and hence benefit from bank-led inflows, the financial income inequality worsens. Along with the worsening of factor income distribution, this causes the total relative

¹⁶ For complete set of the balance sheet of each of the institutions before and after the shock,

income distribution to deteriorate. As one of the highlights of the welfare measures, the rural urban income shows an interesting trend. In both urban and rural areas, the rich and the poor households suffer from factor income loss tracing the sources of the income fall the declining price level holds the key as wages specified as positive functions of price level¹⁷. However, in percentage term largest fall occurs in factor income of urban poor, followed by factor income of rural poor. This is obviously not a favorable outcome given the fact that even the same size of income decline between the rich and poor the real affect fell more by the poor. Among the rich, the percentage decline in rural and urban household income is almost the same. But the fall in their total income is rather different. Among the urban rich the percentage fall is much less than that of the rural rich. The primary reason of this is precisely the presence of financial income. The financial income of the urban rich actually increases whereas the financial income of the rural rich declines (see Figure 2.8). It is clear that the role of financial income modeled in the FCGE is so critical that such an opposite trend can be exposed. Without considering the financial sector in the model any financial trend including that of financial income cannot be disclosed. In this particular scenario, when bank's behavior is shifting towards investing in more risky assets, those who benefit from it are the urban rich who have access on financial investment. Therefore, with the inclusion of financial sector in the model one can explicitly link the behavior of economic agents, in this particular case the agent is the banking sector, and rural-urban income disparity. Hardily any economic models can explicate such a link.

see appendix.

As discussed earlier, firms are also a significant economic agent that decide the level of real sector investment, similar to the what banking sector does, affecting the economy and society. As shown in Table 2.3, firms follow a financial investment pattern similar to that of the banking sector, pursuing high returns in the financial market. Firms, however, also help the real sector economy by increasing their physical investment (RUP 176,412 million). The money borrowed from banks and financed through issuing more equity and security debts (RUP 499,830 million), allows firms to invest more in not only financial assets (RUP 154,599 million) but also in expanding the businesses. The real sector investment as a ratio to the total investment is increased by 4.5% while financial investment is increased by 0.1%. Indeed the real sector investment made by firms has grown 29% during increased bank-led inflow, resulting in high growth¹⁸. We should, however, not forget that the growth failed to improve the income inequalities between the rich and the poor, or between the rural and the urban. As shown in Figure 2.9, it worsens income inequalities although shortly generating high economic growth due to the increased liquidity and the financial boom. As discussed earlier, the behavior, which heavily focuses on financial investment, can also generate vulnerability and volatility in the economy. The economic boom can turn out to be a disaster if a massive capital reversal happens, as

¹⁷ $WAGES_t = PINDEX^{vpi} * \left(\frac{PV_t}{PV0_t}\right)^{(1-vpi)} * \left(\frac{\frac{X_t}{\sum_{fl} FACDEM_{t,fl}}}{PDL0_t}\right)^{phi_t}$; Wage is a function of price index

¹⁸ In a different model simulation where firms invest more in financial assets while decreasing the real sector investment given the less availability of bank loan, the economy experienced less growth than the case where firms increase the real sector investment by 29% -- the prudent firm case. This shows that the level of physical investment and economic growth depends not only on firm's behavior but also banking sector, deciding the availability of loan. Again, however, this does not guarantee improving poverty conditions and income inequalities.

many countries have experienced before falling into a financial crisis. This will be explained in section 2.4.5.

2.4.5. Outflow

Table 2.4. Changes in Bank's Balance Sheet Showing Bank's Risk-taking Behavior during Bank-led Inflows

| Banking sector* | | | |
|--------------------------|-----------|------------|--------------------------|
| Asset | | Liability | |
| Fixed investment | 0.00 | -735.00 | Wealth |
| Money demand | -50986.00 | -146570.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond |
| Short-term securities | 180393.00 | 72367.00 | Short-term securities |
| Credits | 3080.00 | 98.10 | Credits |
| Equity&share | 12364.10 | 219680.00 | Equity&share |
| Others | 0.00 | 0.00 | Others |
| | 144900.00 | 144900.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value during bank-led inflow from baseline

Table 2.5. Changes in Bank's Balance Sheet during Outflow Compared to Bank-led Inflow

| Banking sector*(inflow compared) | | | |
|----------------------------------|-----------|------------|--------------------------|
| Asset | | Liability | |
| Fixed investment | 0.00 | 196.00 | Wealth |
| Money demand | 13653.00 | 99600.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond |
| Short-term securities | -94732.00 | -38003.00 | Short-term securities |
| Credits | -200.00 | -6.20 | Credits |
| Equity&share | -8531.70 | -151590.00 | Equity&share |
| Others | 0.00 | 0.00 | Others |
| | -89800.00 | -89800.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value during outflow from the period when bank-led capital flows into the economy

While bank-led inflows can stimulate the economy, they can also generate vulnerability in the banking sector that can adversely impact the economy through the resulting systemic risks. As discussed above, the flows of cheap money alter the behavior of banks, moving them more towards risk-taking. If most capital from the inflows is used to invest in highly risky financial assets, it will increase bank's vulnerability by lowering the CAR. This can potentially lead to a banking crisis and eventually an economic crisis. The risky investment after bank-led inflows is shown in the balance sheet of the banking sector (Table 2.4). The volume and prices of short-term securities and equity and shares increase, as shown in the asset side of bank's balance sheet. The short-term portfolios and debts consisting mainly of bank-led flows pose a great risk of abrupt outflows when there is an external shock. This causes the balance sheet of agents to deteriorate. The sudden outflows put pressure on the exchange rate to depreciate sharply, damaging the balance sheets of firms or

borrowers that are heavily indebted in foreign currency. This damage done to the balance sheet of firms is incorporated into the bank loan equation in which wealth is affected by the changes in exchange rate. In the event of external shocks, the negative impacts can be much larger due to the systemic role of the financial sector. The recent episode of capital reversal in emerging markets when most of the EU banks had to withdraw their funding serves as a notable example. When bank-led inflows took such an opposite direction, flow volatility increased. Therefore, despite the growth-enhancing advantages of bank-led inflows, its overall effect must be cautiously evaluated in the presence of credit channel.

By analyzing the economy-wide impact, including the balance sheet effect on the banking sector under the scenario of capital flow reversal, one can recognize that the first immediate impact was the opposite direction of equity and securities assets held by the banking sector. As outflows occur, these risky assets decline, causing the total assets of banks also to fall despite the fact that the money demand and amount of currency increases (Table 2.5). One can think of a situation where, given the outflows, a bank may need to adjust its portfolio. This implies the deteriorating bank's balance sheet. Fearful of worsening liquidity condition, banks tend to hold more currency (MD), while continuing to lend in order to avoid worsening economic conditions.

Table 2.6. Changes in Bank's Balance Sheet during Outflow Compared to Baseline

| Banking sector*(baseline compared) | | | |
|------------------------------------|-----------|-----------|--------------------------|
| Asset | | Liability | |
| Fixed investment | 0.00 | -539.00 | Wealth |
| Money demand | -37333.00 | -46970.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 0.00 | Government bond |
| Short-term securities | 85661.00 | 34364.00 | Short-term securities |
| Credits | 2880.00 | 91.90 | Credits |
| Equity&share | 3832.40 | 68090.00 | Equity&share |
| Others | 0.00 | 0.00 | Others |
| | 55100.00 | 55100.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value during outflow from baseline

To what extent has this new equilibrium outcome changed from the baseline (i.e., before the bank-led flows took place)? It is clear that the amount of loans extended from the banking sector is lower and the overall wealth of the bank in nominal terms as well as ratio terms is also lower (see Table 2.6).

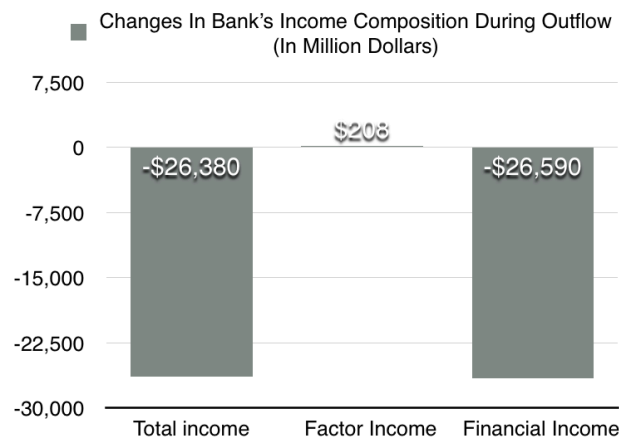


Figure 2.10. Changes in Bank's Income Composition During Outflow Compared to Baseline

The total income of the banking sector decreases by as much as the fall in its financial income (Figure 2.10), highlighting the critical role of financial assets in determining the income or capital of the sector. The outflows also negatively affect the income of non-financial firms, banks, and financial firms (Figure 2.11). Although their factor incomes are all increasing, the total incomes decrease due to a decline in the financial income. This shows how financial income can hold the key to the determining the level of income. Non-financial firms, financial firms, and banks all experience negative effects of outflows. The economy as a whole thus experiences a decline in total and financial income. In the case of rural rich and poor households, and urban poor households, the decrease in prices of assets has little (if any) influence on their income, while the increase in factor income enables them to enjoy income increase. This is due to the fact that they do not possess much securities and equity and share assets (the rural rich have few while others have none). The dependency of poor and rich households in rural areas, and poor households in urban areas, on factor income is greater than their dependency on financial income. Therefore, what happens in terms of financial assets barely affects their income because they own limited financial assets. The negative financial income effect on rich households in urban areas and lack of effect on other households thus generates an improvement in the overall relative income distribution. However, this welfare results under the scenario of capital outflows should not be considered as favorable because when we compare with the baseline results prior to capital inflows the incomes of all category of households are lowered. More seriously, the percentage income fall of the rural poor and rural rich is larger than the percentage income fall of urban poor and urban rich,

respectively (see Figure 2.14). Hence the inflow and outflow sequence (also know as boom and bust) is damaging when the rural urban household income is used as the key measure of welfare.

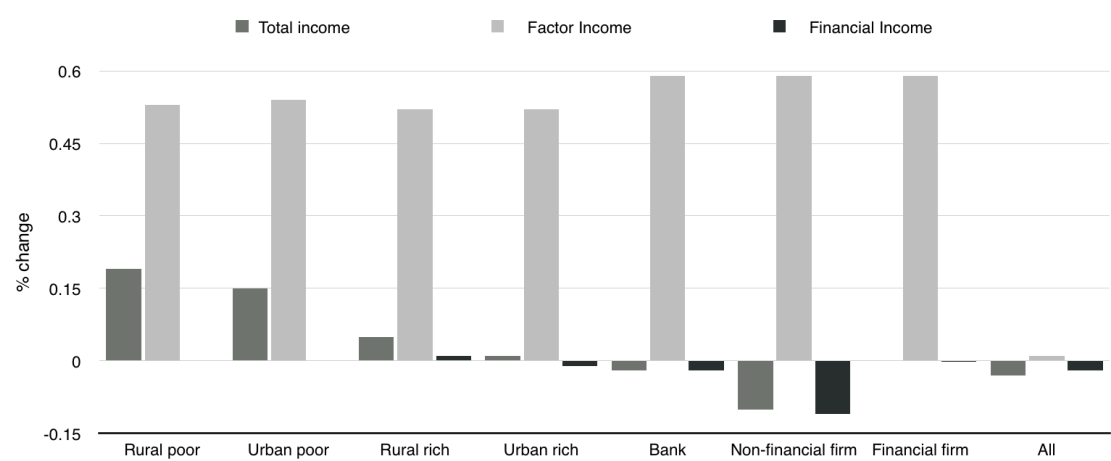


Figure 2.11. % Changes in Income of Domestic Institutions during Outflow Compared to the Bank-led Inflow

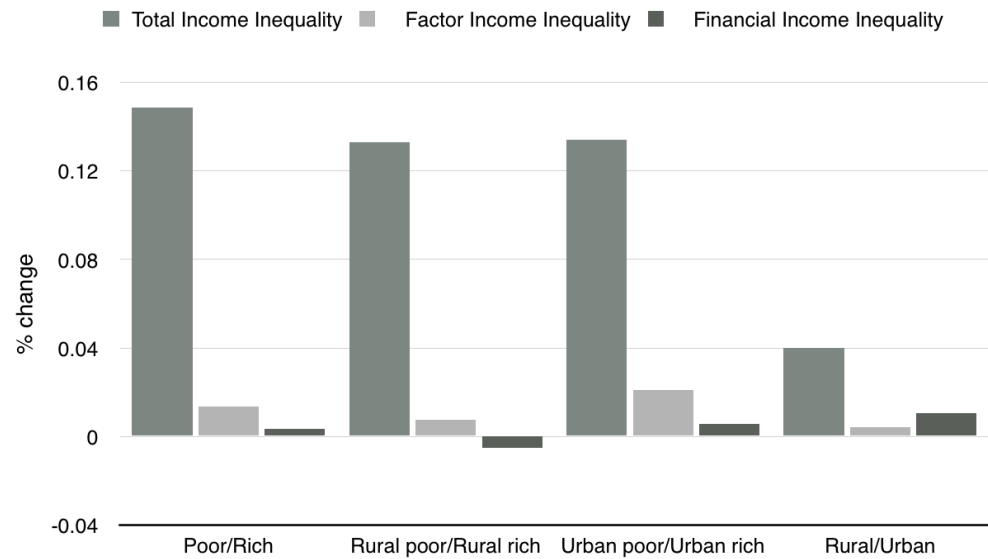


Figure 2.12. % Changes in Household Income Distributions During Outflow

Compared to Increased Bank-led Inflow

The impacts of capital flow reversal on the macro-economy are as expected. The immediate one is on the exchange rate. In both nominal and real terms, the exchange rate depreciates (Figure 2.13). As described in the model structure earlier, a depreciation of exchange rate has a negative impact on investment. As a result, total investment declines despite the fact that value added has increased due to increased export, and interest rates decline. The latter is caused by the falling return on financial assets after capital outflows take place. The increase in export along with higher consumption, however, leads to higher GDP, which in turn raises the factor income and household income. Notice that real GDP is slightly decreased because the exchange rate depreciation puts upward pressure on prices and it cancels the positive effect of the increased export and consumption on RGDP. With higher factor income across all households and relatively unchanged financial income, the overall income distribution is relatively favorable; however, the poverty line tends to increase since the price index also increases. As discussed earlier, it is impossible to determine precisely what happens with the incidence of poverty, especially when the income of the poor increases. If we compare this scenario of post-capital outflows with the baseline scenario before the bank-led inflows, we can see that income distribution has worsened although the poverty line declined. In particular, financial incomes of the urban rich, banks, non-financial firms, and government decrease sharply, as shown in Figure 2.14. This shows that, during outflows, those who have financial assets suffer more than those who do not. This, along with the worsening of firm's wealth, clearly

indicates that the boom-and-bust scenario, i.e., from bank-led inflows to bank-led outflows, does not result in improved welfare. It is also clear that the vulnerability I have shown in the previous scenario is proven to be a determining factor. Therefore, the risks associated with bank-led inflows can overshadow its benefits.

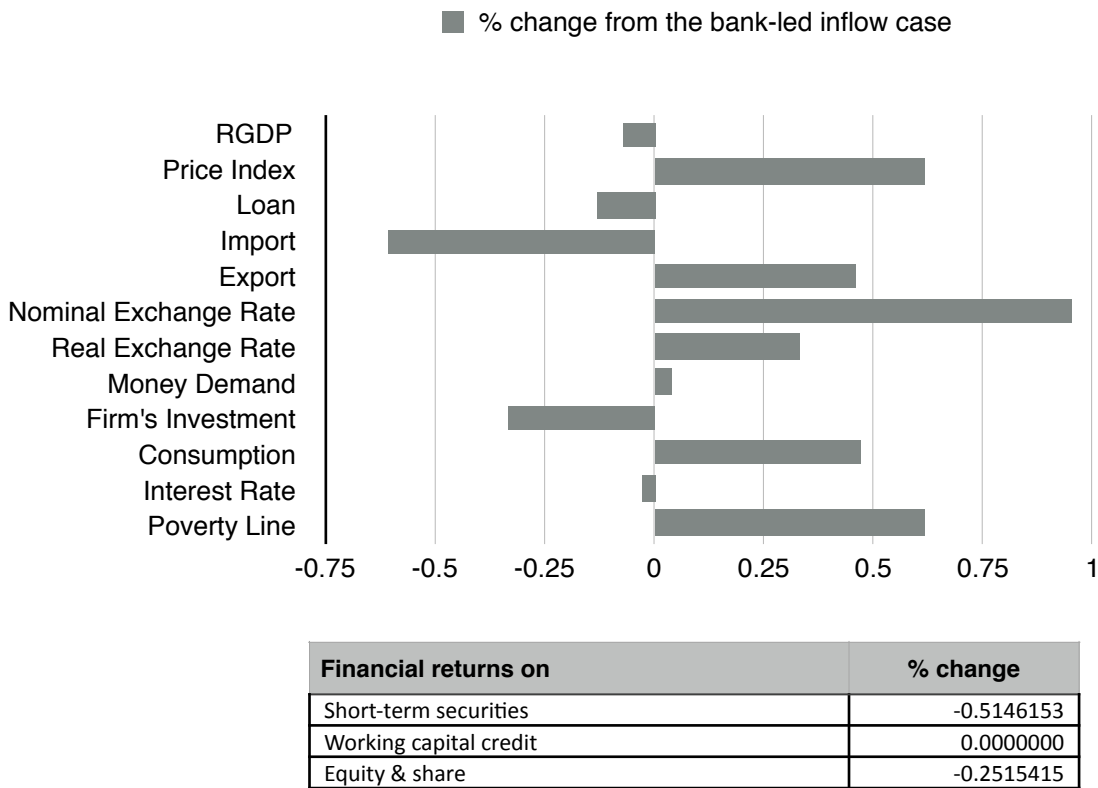


Figure 2.13. % Changes in Real Sector Variables During Outflow Compared to Bank-led Inflow

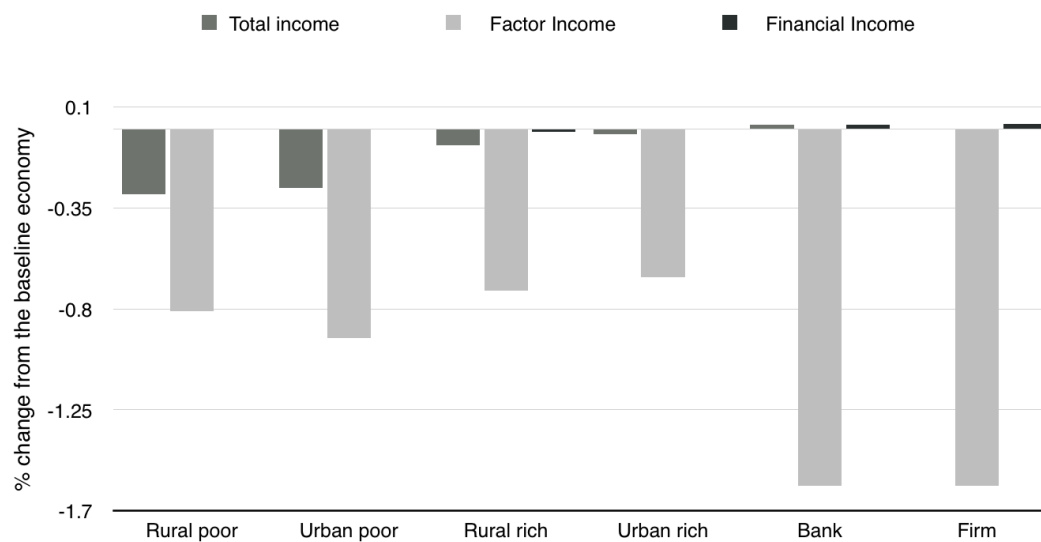


Figure 2.14. % Changes in Income of Domestic Institutions during Outflow

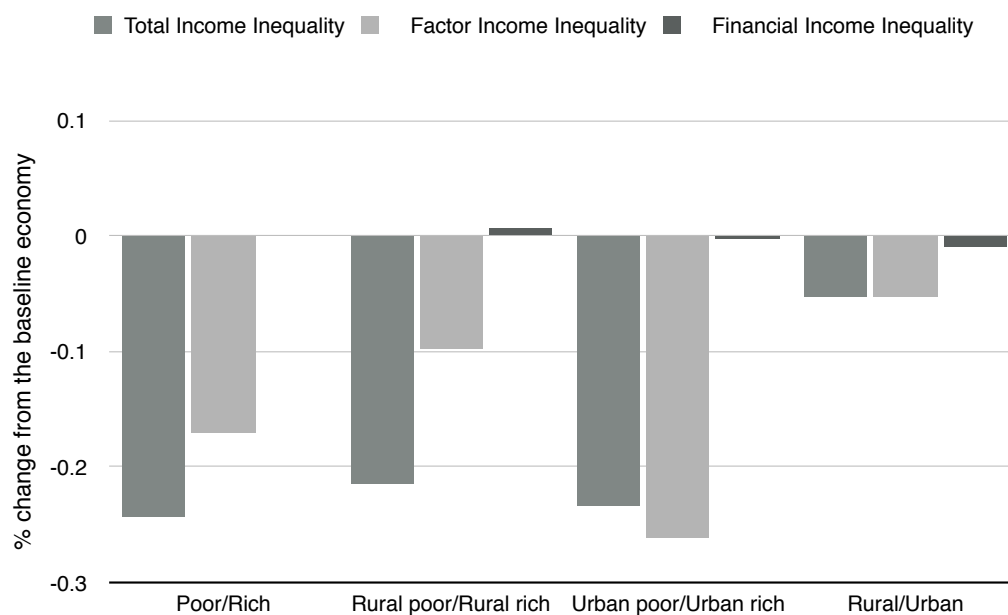


Figure 2.15. % Changes in Household Income Distributions during Outflow

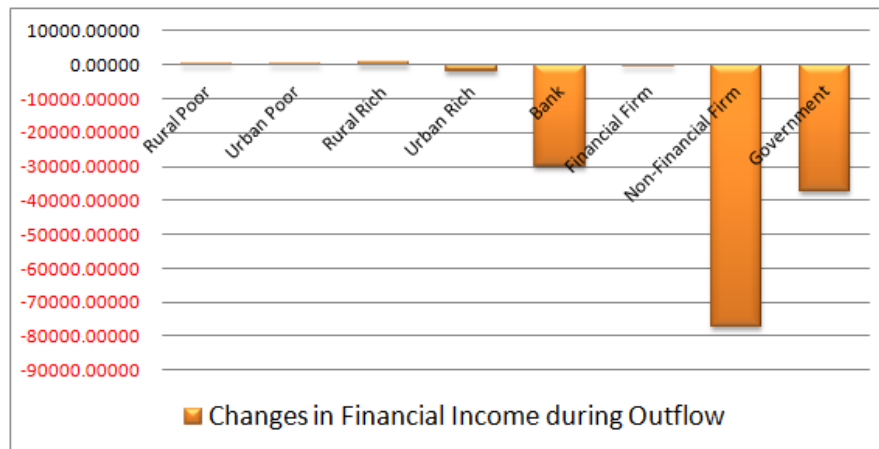


Figure 2.16. Changes in Financial Incomes of Domestic Institutions during Outflow

2.4.6. Prudent Behavior of Banking Sector Under Bank-led Inflow

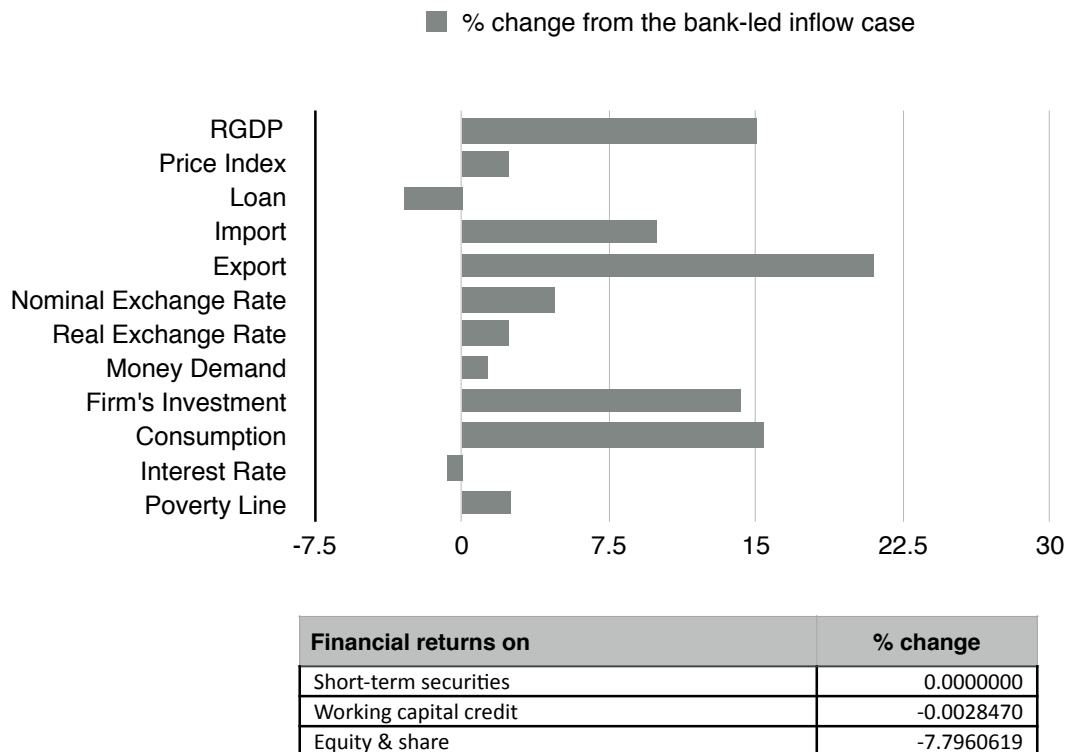


Figure 2.17. % Changes in Real Sector Variables under Bank's Prudent Behavior

There are two possible categories of bank behavior given the foreign capital available in their liability side: risky and non-risky. Previously in the model, the bank behavior was such that the increase in liquidity due to CFLOW was mostly allocated to risky assets, such as equity and short-term securities.¹⁹ Such investments will decrease CAR (capital/risky asset). The other category is bank's non-risky behavior where the banks become risk-averse, i.e., increasing money demand (capital). The impact of such different behaviors on the economy will also differ. What would happen if the bank behavior were to favor non-risky assets, in particular, allocating most of the additional liquidity into more liquid money demand (Table 2.7)?

The results indicate that the economy would also be growing (15%); however, unlike before, the capital inflows through the banking sector would lead to increased liquidity prices. Usually, when there is a capital inflow, the demand for domestic assets will rise, causing the price to increase. The result in the current scenario seems to be in line with such a scenario. The general price index is also higher. The size of the equity price also indicates that increased CFLOW may lead to a price bubble (Figure 2.17). Precisely because of this, unlike before, the resulting exchange rate is depreciating²⁰. Also, the prices in real sector and financial sector had upward pressure as banks and other institutions increased money demand. Thus, unlike in the scenario of risky behavior, both the macro and social issues improve; however, the risk of asset

¹⁹ Increasing credit assets alternatively is a risky behavior of banks, especially during an economic downturn, thereby decreasing CAR as it forms a vicious cycle as mentioned in Section 2.

²⁰ This is confirmed by conducting another model simulation excluding credit channel and equation of motion, given the same constraints and CFLOW shock. These simulation results show that the exchange rate is appreciated while price is decreased. Price plays a critical role in the direction of the EXR in the model.

bubble creation emerges.

Table 2.7. Changes in Bank's Balance Sheet Showing Bank's Prudent Behavior

| Banking sector* | | | |
|--------------------------|------------|-------------|--------------------------|
| Asset | | Liability | |
| Fixed investment | 0.00 | 6264.00 | Wealth |
| Money demand | 425197.00 | 3153240.00 | Money demand |
| Saving deposit | 0.00 | 0.00 | Saving deposit |
| Central bank certificate | 0.00 | 0.00 | Central bank certificate |
| Government bond | 0.00 | 1772842.90 | Government bond |
| Short-term securities | 0.00 | 0.00 | Short-term securities |
| Credits | -4300.00 | -137.30 | Credits |
| Equity&share | -269046.80 | -4780360.00 | Equity&share |
| Others | 0.00 | 0.00 | Others |
| | 151900.00 | 151900.00 | |

*The numbers (in million Indonesian rupiah) represent absolute changes in each value during bank-led inflow from baseline

The fact that most of the increased liquidity goes to non-risky assets of the bank also implies that the bank's vulnerability is reduced. As shown in Table 2.7, the foreign capital is invested in the form of demand deposits in banks. In response to the increased money demand, the banking sector tries to secure cash for any withdrawal requests on demand deposits. The banking sector buys back the equity and share assets to deposit them in checking accounts (money demand is increased by Rup 425197 million in the asset side). This behavior of the banking sector drives up the price of the equity and share assets by decreasing the supply in the market, which in turn, decreases the financial returns on the equity and share assets. The low returns make investors, including the banking sector, lose the motivation to invest. The banking

sector sells the equity and share assets while increasing the money demand and wealth. In an extreme risk-aversion case, the banking sector even calls the credits that it issued. This risk-aversion behavior of the banking sector yields different implications on the economy and society when compared with the case of banks become risk-taking.

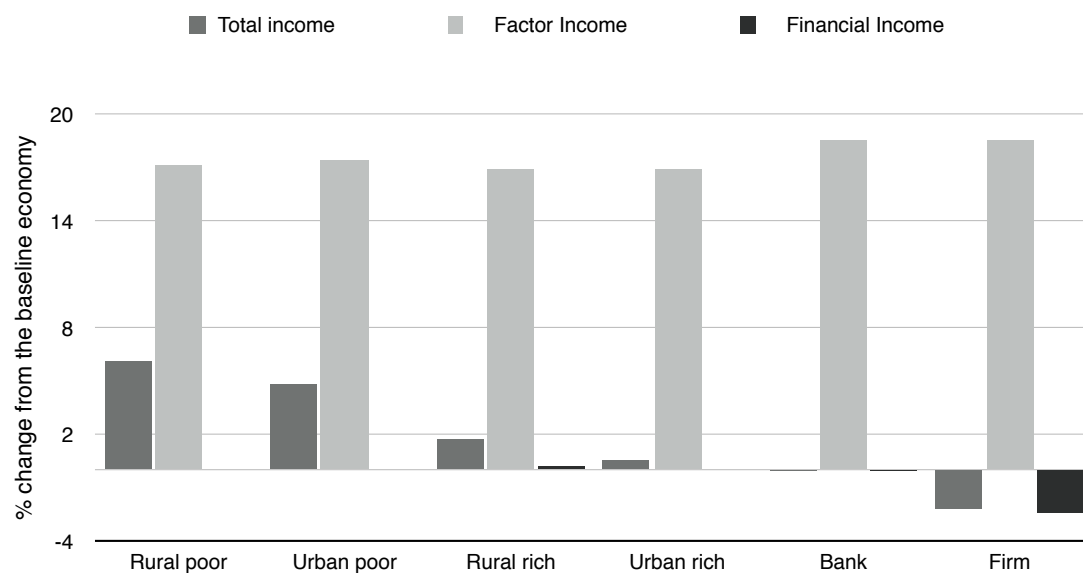


Figure 2.18. % Changes in Income of Domestic Institutions under Bank's Prudent Behavior

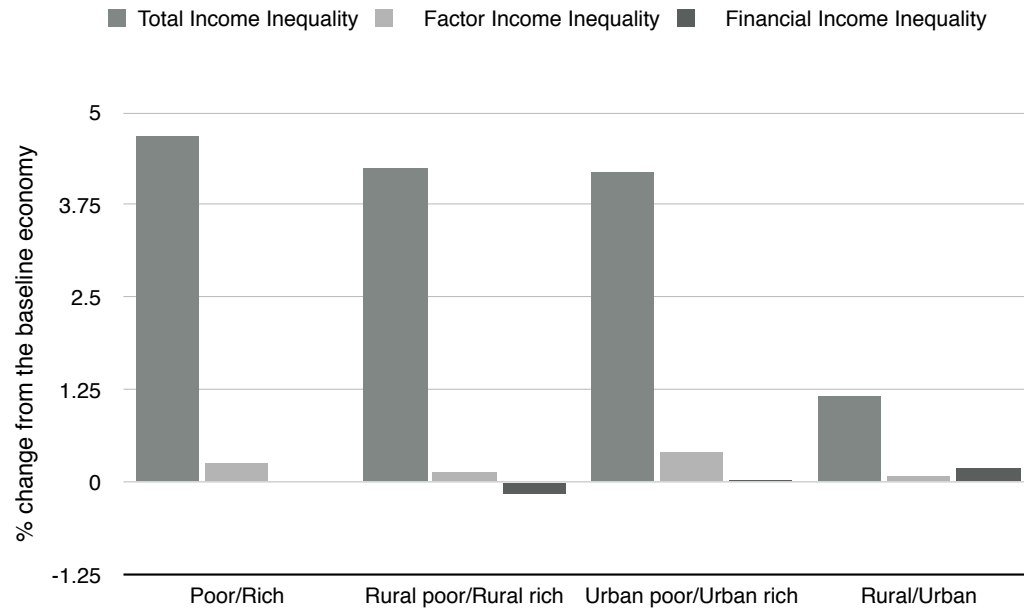


Figure 2.19. % Changes in Household Income Distributions under Bank's Prudent Behavior

Based on the household income shown in Figure 2.18, the growing economy produces higher factor income for all categories of households, the largest percentage increases of which are for the poor (i.e., rural and urban); however, the non-risky behavior of the banks, combined with the fact that return on financial assets declines, alter the distribution of financial income for rural poor and rich, while the financial income of the urban poor increases, although their ownership volume is relatively small, and the financial income of the large holders of the financial asset (i.e., urban rich) decreases (0.3%). Which such a trend the overall income distribution between rural and urban households improves the largest percentage improvements of which occurs in financial income distribution (see Figure 2.19). It is also interesting to note that the percentage improvement in rural rich income is much higher than the one in the rural poor such that the financial income inequality among rural households

worsens. The poverty line under the current scenario is increasing, which suggests that the improved income inequality should be analyzed in more detail in terms of whose income has decreased or increased (Figure 2.17 and 2.18). Judging from the simulation results, the total income of the rural and urban poor increases the most. Combined with the increase of the poverty line, which is less than the rate of the increase of the income of the poor, this suggests that the incidence of poverty tends to decrease.

Under the non-prudent behavior of the banking sector, the economy experiences a higher growth rate (18% vs. 15%) than the economy under the prudent behavior of banking sector. The economy, however, suffers from worsening poverty conditions and income inequalities that can harm the sustainability of growth in the medium and long term²¹, while social conditions improve under the prudent behavior of banking sector. Thus, overall the prudent behavior of the banking sector can not only help the growth of the economy in the medium and long run but also help improve social conditions.

2.5. Concluding Remarks

In this chapter, we investigated the role of the banking sector in determining the availability of loans in emerging markets that experience massive capital inflows. For that purpose, we incorporated credit channel theory into the FCGE model. As this theory places heavy emphasis on the role of the banking sector in the availability of

loans, the FCGE model is specified in such a way that loan availability does not depend solely on interest rate but also on the financial structures of banks and borrowers – i.e., the credit channel. In the model, thus, banks' behavior or any phenomena that can alter banks' behavior, such as changes in banks' balance sheet and borrowers' financial structure, matter more than the interest rate that is believed to be the main driving force of loan availability. We update the credit channel such that changes in exchange rate in the previous period also affect the financial structure of lenders and borrowers by inflating or deflating asset values in the next period, thereby changing banks' behavior in lending.

Another important focus of this chapter is the implications of policy shocks on urban-rural income inequality, which is highlighted as the most important measure of welfare. To the extent that the total income received by urban and rural households comes from factor income, income transfer, and financial income, the dynamics of these categories of income determine the total as well as the distribution of income. When the focus of investment leans towards financial assets that are usually more risky, the resulting growth of the financial sector does not necessarily imply improved welfare because only those who have more access to the financial market, i.e., usually the urban rich households, will gain. This worsens the income inequality between the rich and the poor as well as between rural and urban households. Thus, the seemingly unrelated phenomena of capital flows (in this case, bank-led flows) and household spatial income distribution actually have a clear relation, as shown by the FCGE model simulations. When bank-led flows led to more investment in risky financial

²¹ Stiglitz (2013) in his book “The Price of Inequality:...” illustrates why and how inequalities

assets, relatively wealthy households living in urban areas can gain much more than the rest of the society. If the increased financial assets also lead to growing output (real sector), then the resulting factor income will improve the relative position of the non-rich because a large share of the latter's income comes from factor income; however, if the financial assets do not translate into real sector and instead re-circulate in the financial market with limited spillover to the real sector, then the benefits of the growing economy go largely to the urban rich. Unfortunately, this latter scenario seems to be more common in most emerging market economies.

The above conjectures are supported by the results of model simulations under different scenarios. Four types of scenarios were simulated using the FCGE model. The first scenario is to analyze the role of dynamic credit channel where changes in the exchange rate affect the local currency value of the balance sheets of lenders and borrowers. It was found that incorporating the effect of exchange rate changes on the balance sheets exacerbates the macro and social impacts of increased bank-led flows. While the macro impact is better, the social repercussions are even worse than in the static credit channel model. The second scenario is an increase in bank-led flows (banks' non-core liabilities). Given the specification of the model, most of the increase is used by banks to invest in risky assets, such as securities and equities. This reflects the risk-taking behavior of banks. The results suggest that although, from the macroeconomic perspective, the economy will improve due to stronger liquidity, the social indicators such as income inequality and poverty condition will worsen. The firms follow a financial investment pattern similar to that of the banking sector,

can hinder growth.

pursuing high returns in the financial market. Firms, however, also help the real sector economy by increasing their physical investment. The money borrowed from banks and financed through issuing more equity and security debts, allows firms to invest more, not only in financial assets, but also in expanding the businesses. Although this allows the economy to grow, this behavior of firms did not help improve the income distributions. This implies the behavior of the banking sector plays a more important role in the economy than that of firms. Third, following the common boom and bust trend in many countries, we investigate a scenario of capital flow reversal – i.e., increased bank-led flows followed by capital outflows. All the risks that emerged during the rising bank-led flows either disappear or shrink; however, when the results are compared with the baseline (before the boom and bust), the social indicators worsen. The last scenario analyzes what happens if the additional funds raised from increased non-core liabilities are spent by banks more prudently rather than being invested in risky assets. This reflects a risk-averse behavior of banks. This scenario turns out to be most favorable as both the macro conditions and social indicators improve. In particular, the spatial income inequality between rural and urban areas decreases, and the incidence of poverty tends to decline.

From these four scenarios, two major conclusions can be derived. First, ignoring the role of exchange rate changes in banks' behavior (i.e., the dynamic component of credit channel) can yield an inaccurate picture of the impact of increased bank-led flows. The macroeconomic outcome is underestimated, so are the negative effects on social indicators. Secondly, boom and bust cycle can be detrimental to the economy. One should especially not overlook the social impacts

of such cycle. Unless banks are prudent in using the additional funds that come from increased bank-led flows, attempts must be made to avoid such a boom and bust cycle. The analysis in the next chapter will focus specifically on what kind of policies would support such attempts.

The most important contribution of the exercise in this chapter is that it shows how the FCGE model is capable of capturing the transmission mechanisms between the seemingly unrelated phenomena of macro-financial shock and spatial or rural-urban income disparity, which is highlighted as the most important measure of welfare. While many studies have elaborated the mechanism and impact of capital flows, as far as we know, they seldom draw an explicit link between macro-financial shock and spatial welfare measure. For future studies, it would be useful to extend upon this analysis by incorporating more financial instruments and other social indicators, or improving the accuracy of the parameters involved in the model. For example, rather than calibrating all of the parameters, one could estimate at least some of them by utilizing econometric equations with time series data.

APPENDIX

Description Of The FCGE Model

EQUATIONS

Price Block

$$1. \quad PMDEF(i) \$M0(i) \dots \quad PM(i) \quad =E= \quad PWM(i) * EXR * (1 + tm(i) + ttf(i) - psubm(i)) \quad ;$$

$$PM_i = PWM_i * EXR * (1 + tm_i + ttf_i - psubm_i)$$

$$2. \quad PEDEF(i) \$E0(i) \dots \quad PE(i) \quad =E= \quad PWE(i) * EXR / (1 - psube(i)) \quad ;$$

$$PE_i = \frac{(PWE_i * EXR)}{(1 - psube_i)}$$

$$3. \quad ABSORPTION(i) \dots \quad PQ(i) * Q(i) \quad =E= \quad PD(i) * D(i) + (PM(i) * M(i)) \$M0(i) \quad ;$$

$$PQ_i * Q_i = PD_i * D_i + PM_i * M_i$$

$$4. \quad SALES(i) \dots \quad PX(i) * X(i) \quad =E= \quad (1 - tdom(i) - ttd(i) - impf(i)) * PD(i) * D(i) + PE(i) * E(i) + SUB(i) \quad ;$$

$$PX_i * X_i = (1 - tdom_i - ttd_i - impf_i) * PD_i * D_i + (PE_i * E_i) + SUB_i$$

$$5. \quad ACTP(i) \dots \quad PV(i) * VA(i) \quad =E= \quad PX(i) * X(i) - PINTM(i) * INTM(i) \quad ;$$

$$PV_i * VA_i = (PX_i * X_i) - (PINTM_i * INTM_i)$$

$$6. \quad PINTDEF(i) \dots \quad PINTM(i) * INTM(i) \quad =E= \quad (PDINTM(i) * DINTM(i) + PFINTM(i) * FINTM(i)) \quad ;$$

$$PINTM_i * INTM_i = (PDINTM_i * DINTM_i) + (PFINTM_i * FINTM_i)$$

$$7. \quad PDINTDEF(i) \dots \quad PDINTM(i) \quad =E= \quad \sum_j (aad(j, i) * PQ(j)) \quad ;$$

$$PDINTM_i = \sum_j (aad_{j,i} * PQ_j)$$

$$8. \quad PFINTDEF(i) \dots \quad PFINTM(i) \quad =E= \quad \sum_j (aaf(j, i) * PQ(j)) \quad ;$$

$$PFINTM_i = \sum_j (aaf_{j,i} * PQ_j)$$

$$9. \quad PKDEF(i) \dots \quad PK(i) \quad =E= \quad \sum_j (PQ(j) * capmat(j, i)) \quad ;$$

$$PK_i = \sum_j (PQ_j * capmat_{j,i})$$

$$10. \quad PINDEXDEF \dots \quad PINDEX \quad =E= \quad GDP / RGDP \quad ;$$

$$PINDEX = \frac{GDP}{RGDP}$$

$$11. \quad WTQEQ(i) \dots \quad wtq(i) \quad =E= \quad Q(i) / \sum_j (Q(j)) \quad ;$$

$$wtq_i = \frac{Q_i}{\sum_j Q_j}$$

Distortion Block

$$1. \quad \text{DTTMEQ}(i) \dots \quad \text{DTTM}(i) \quad =E= \quad \text{ttd}(i) * \text{PD}(i) * \text{D}(i) \quad ;$$

$$\text{DTTM}_i = \text{ttd}_i * \text{PD}_i * \text{D}_i$$

$$2. \quad \text{FTTMEQ}(i) \dots \quad \text{FTTM}(i) \quad =E= \quad \text{ttf}(i) * \text{PWM}(i) * \text{EXR} * \text{M}(i) \quad ;$$

$$\text{FTTM}_i = \text{ttf}_i * \text{PWM}_i * \text{EXR} * \text{M}_i$$

$$3. \quad \text{ITAXEQ}(i) \dots \quad \text{INDTAX}(i) \quad =E= \quad \text{tdom}(i) * \text{PD}(i) * \text{D}(i) \quad ;$$

$$\text{INDTAX}_i = \text{tdom}_i * \text{PD}_i * \text{D}_i$$

$$4. \quad \text{TRIFEQ}(i) \dots \quad \text{TARIFF}(i) \quad =E= \quad \text{tm}(i) * \text{PWM}(i) * \text{EXR} * \text{M}(i) \quad ;$$

$$\text{TARIFF}_i = \text{tm}_i * \text{PWM}_i * \text{EXR} * \text{M}_i$$

$$5. \quad \text{IMPERQ}(i) \dots \quad \text{IMPERFECT}(i) \quad =E= \quad \text{impf}(i) * \text{PD}(i) * \text{D}(i) \quad ;$$

$$\text{IMPERFECT}_i = \text{impf}_i * \text{PD}_i * \text{D}_i$$

$$6. \quad \text{SUBEQ}(i) \dots \quad \text{SUBE}(i) \quad =E= \quad \text{psube}(i) * \text{PE}(i) * \text{E}(i) \quad ;$$

$$\text{SUBE}_i = \text{psube}_i * \text{PE}_i * \text{E}_i$$

$$7. \quad \text{SUBMQ}(i) \dots \quad \text{SUBM}(i) \quad =E= \quad \text{psubm}(i) * \text{PWM}(i) * \text{EXR} * \text{M}(i) \quad ;$$

$$\text{SUBM}_i = \text{psubm}_i * \text{PWM}_i * \text{EXR} * \text{M}_i$$

Production Block

$$1. \quad \text{OUTPUT}(i) \dots \quad \text{X}(i) \quad =E= \quad \text{ai}(i) * (\text{bi}(i) * \text{VA}(i) ** (-\text{rhoi}(i)) + (1-\text{bi}(i)) * \text{INTM}(i) ** (-\text{rhoi}(i))) ** (-1/\text{rhoi}(i)) \quad ;$$

$$\text{X}_i = \text{ai}_i * (\text{bi}_i * \text{VA}_i^{-\text{rhoi}_i} + (1 - \text{bi}_i) * \text{INTM}_i^{-\text{rhoi}_i})^{-1/\text{rhoi}_i}$$

$$2. \quad \text{INTEQ}(i) \dots \quad \text{INTM}(i) \quad =E= \quad \text{VA}(i) * ((\text{PV}(i) / \text{PINTM}(i)) * ((1-\text{bi}(i)) / \text{bi}(i))) ** (1/(1+\text{rhoi}(i))) \quad ;$$

$$\text{INTM}_i = \text{VA}_i * \left(\frac{\text{PV}_i}{\text{PINTM}_i} * \frac{(1-\text{bi}_i)}{\text{bi}_i} \right)^{1/(1+\text{rhoi}_i)}$$

$$3. \quad \text{VADEF}(i) \dots \quad \text{VA}(i) \quad =E= \quad \text{avx}(i) * \text{av}(i) * (\text{SUM}(f, \text{bv}(i, f) * \text{FACDEM}(i, f) ** (-\text{rhov}(i)))) ** (-1/\text{rhov}(i)) \quad ;$$

$$\text{VA}_i = \text{avx}_i * \text{av}_i * (\sum_f \text{bv}_{i,f} * \text{FACDEM}_{i,f}^{-\text{rhov}_i})^{-1/\text{rhov}_i}$$

$$4. \quad \text{FACTDEQ}(i, f) \$ \text{WFDIST0}(i, f) \dots \quad \text{FACDEM}(i, f) \quad =E= \quad \text{VA}(i) * ((\text{bv}(i, f) * \text{PV}(i))$$

$$/ (\text{WF}(f) * \text{WFDIST}(i, f) * (\text{avx}(i) * \text{av}(i)) ** \text{rhov}(i))) ** (1/(1+\text{rhov}(i))) \quad ;$$

$$\text{FACDEM}_{i,f} = \text{VA}_i * \left(\frac{\text{bv}_{i,f} * \text{PV}_i}{\text{WF}_f * \text{WFDIST}_{i,f} * (\text{avx}_i * \text{av}_i)^{\text{rhov}_i}} \right)^{1/(1+\text{rhov}_i)}$$

$$5. \quad WAGEEQ(i) \dots \quad WAGES(i) = E = (PINDEX^{vp_i}) * ((PV(i)/PV0(i))^{(1-vp_i)}) * ((X(i)/SUM(fl, FACDEM(i, fl))/PDL0(i))^{phi_i}) ;$$

$$WAGES_i = PINDEX^{vp_i} * \left(\frac{PV_i}{PV0_i} \right)^{(1-vp_i)} * \left(\frac{\frac{X_i}{\sum_{fl} FACDEM_{i,fl}}}{PDL0_i} \right)^{phi_i}$$

$$6. \quad WFLABOR(fl) \dots \quad WF(fl) = E = WF0(fl) * SUM(i, WAGES(i) * wlshare(i, fl)) ;$$

$$WF_{fl} = WF0_{fl} * \sum_i (WAGES_i * wlshare_{i,fl})$$

$$7. \quad INTERM(i) \$ FINTM0(i) \dots \quad INTM(i) = E = at(i) * (bt(i) * DINTM(i)^{(-rhot(i))} + (1-bt(i)) * FINTM(i)^{(-rhot(i))})^{(-1/rhot(i))} ;$$

$$INTM_i = at_i * (bt_i * DINTM_i^{-rhot_i} + (1 - bt_i) * FINTM_i^{-rhot_i})^{-1/rhot_i}$$

$$8. \quad INTERM2(i) \$ (FINTM0(i)=0) \dots \quad INTM(i) = E = DINTM(i) ;$$

$$INTM_i = DINTM_i$$

$$9. \quad INTEREQ(i) \$ FINTM0(i) \dots \quad FINTM(i) = E = DINTM(i) * ((PDINTM(i)/PFINTM(i))^{(1-bt(i))/bt(i))})^{(1/(1+rhot(i)))} ;$$

$$FINTM_i = DINTM_i * \left(\frac{PDINTM_i}{PFINTM_i} * \frac{(1-bt_i)}{bt_i} \right)^{1/(1+rhot_i)}$$

$$10. \quad ARMINGTON(i) \$ M0(i) \dots \quad Q(i) = E = aq(i) * (bq(i) * D(i)^{(-rhoq(i))} + (1-bq(i)) * M(i)^{(-rhoq(i))})^{(-1/rhoq(i))} ;$$

$$Q_i = aq_i * (bq_i * D_i^{-rhoq_i} + (1 - bq_i) * M_i^{-rhoq_i})^{-1/rhoq_i}$$

$$11. \quad COSTMIN(i) \$ M0(i) \dots \quad M(i) = E = D(i) * ((PD(i)/PM(i))^{(1-bq(i))/bq(i))})^{(1/(1+rhoq(i)))} ;$$

$$M_i = D_i * \left(\frac{PD_i}{PM_i} * \frac{(1-bq_i)}{bq_i} \right)^{1/(1+rhoq_i)}$$

$$12. \quad CET(i) \$ E0(i) \dots \quad X(i) = E = ax(i) * (bx(i) * D(i)^{(rhox(i))} + (1-bx(i)) * E(i)^{(rhox(i))})^{(1/rhox(i))} ;$$

$$X_i = ax_i * (bx_i * D_i^{rhox_i} + (1 - bx_i) * E_i^{rhox_i})^{1/rhox_i}$$

$$13. \quad MAXREV(i) \$ E0(i) \dots \quad E(i) = E = D(i) * ((PE(i)/((1-tdom(i)-ttd(i)-impf(i)) * PD(i))) * (bx(i)/(1-bx(i))))^{(1/(rhox(i)-1))} ;$$

$$E_i = D_i * \left(\left(\frac{PE_i}{(1-tdom_i-ttd_i-impf_i)} \right) * \left(\frac{bx_i}{1-bx_i} \right) \right)^{1/(rhox_i-1)}$$

$$14. \quad INTQEQ(i) \dots \quad INTQ(i) = E = SUM(j, aad(i, j) * DINTM(j) + aaf(i, j) * FINTM(j)) ;$$

$$INTQ_i = \sum_j (aad_{i,j} * DINTM_j + aaf_{i,j} * FINTM_j)$$

$$15. \quad TTMEQ(i) \dots \quad TTM(i) = E = DTTM(i) + FTTM(i) ;$$

$$TTM_i = DTTM_i + FTTM_i$$

16. $TTMXEQ(i) \dots TTMX(i) =E= ttx(i) * SUM(j, TTM(j)) ;$

$$TTMX_i = ttx_i * \sum_j TTM_j$$

17. $DTAXEQ(gin, din) \dots DIRTAX(gin, din) =E= dtax(gin, din) * INC(din) ;$

$$DIRTAX_{gin, din} = dtax_{gin, din} * INC_{din}$$

Income Block

1. $YFEQ(f) \dots YF(f) =E= SUM(i, WF(f) * WFDIST(i, f) * FACDEM(i, f)) + SUM(fr, YFROW(f, fr)) ;$

$$YF_f = \sum_i (WF_f * WFDIST_{i,f} * FACDEM_{i,f}) + \sum_{fr} YFROW_{f,fr}$$

2. $DINCOME(ngi) \dots INC(ngi) =E= SUM(f, factoin(ngi, f) * YF(f)) + SUM(in2, ITRAN(ngi, in2)) + SUM(as, rn.l(as) * Assets.l(as, ngi)) ;$

$$INC_{ngi} = \sum_f (factoin_{ngi,f} * YF_f) + \sum_{in2} ITRAN_{ngi, in2} + \sum_{as} Asset_{as, ngi} * RN_{as}$$

3. $GINCOME(gin) \dots INC(gin) =E= SUM(f, factoin(gin, f) * YF(f)) + SUM(in2, ITRAN(gin, in2)) + gishr(gin) * SUM(i, IND TAX(i) + TARIFF(i)) + SUM(as, rn.l(as) * Assets.l(as, gin)) ;$

$$INC_{gin} = \sum_f (factoin_{gin,f} * YF_f) + \sum_{in2} ITRAN_{gin, in2} + (gishr_{gin} * \sum_i (IND TAX_i + TARIFF_i) + \sum_{as} Asset_{as, gin} * RN_{as})$$

4. $YDISTRUO = (INC0("HHH1") + INC0("HHH2")) / (INC0("HHH3") + INC0("HHH4")) ;$

5. $YDISTLHO = (INC0("HHH1") + INC0("HHH3")) / (INC0("HHH2") + INC0("HHH4")) ;$

Transfer Block

1. $ITRANEQ(in, in2) \dots ITRAN(in, in2) =E= GTRAN(in, in2) + OTRAN(in, in2) ;$

$$ITRAN_{in, in2} = GTRAN_{in, in2} + OTRAN_{in, in2}$$

2. $GTRANEQ(gin, din) \dots GTRAN(gin, din) =E= DIRTAX(gin, din) ;$

$$GTRAN_{gin, din} = DIRTAX_{gin, din}$$

3. $RTRANEQ(h, in2) \dots RTRAN(h, in2) =E= RNshare(h) * SUM(asrn, RN(asrn) * LiabSLag(in2, asrn)) ;$

$$RTRAN_{h, in2} = RNshare_h * \sum_{asrn} (RN_{asrn} * LiabSLag_{in2, asrn})$$

4. $RNShrEQ(in) \dots RNshare(in) =E= SUM(asrn, RN(asrn) * AssetSLag(asrn, in)) / SUM((asrn, in2), RN(asrn) * AssetSLag(asrn, in2)) ;$

$$RNshare_{in} = \frac{\sum_{asrn} RN_{asrn} * AssetSLag_{asrn, in}}{\sum_{asrn} \sum_{in2} (RN_{asrn} * AssetSLag_{asrn, in2})}$$

RTRAN.FX(in,in2) = RTRAN.L(in,in2) ;
RTRAN.LO(h,in) = -INF ; RTRAN.UP(h,in) = +INF ;
RTRAN.FX(h,in2)\$ (RTRAN0(h,in2)=0) = RTRAN.L(h,in2) ;

Expenditure Block

1. YCONEQ(h).. YCONS(h) =E= (INC(h) - SUM(gin, DIRTAX(gin,h)))*(1-mps(h)) - SUM(ngi, ITRAN(ngi,h)) - SUM(fr, ITRAN(fr,h)) ;

$$YCONS_h = (INC_h - \sum_{gin} DIRTAX_{gin,h})(1 - mps_h) - \sum_{ngi} ITRAN_{ngi,h} - \sum_{fr} ITRAN_{fr,h}$$

2. HEXPEQ(h).. EXP(h) =E= YCONS(h) + SUM(gin, DIRTAX(gin,h)) + SUM(ngi, ITRAN(ngi,h)) + SUM(fr, ITRAN(fr,h)) ;

$$EXP_h = YCONS_h + \sum_{gin} DIRTAX_{gin,h} + \sum_{ngi} ITRAN_{ngi,h} + \sum_{fr} ITRAN_{fr,h}$$

3. GEXPEQ(gin).. EXP(gin) =E= ggshr(gin)*SUM(i, PQ(i)*GD(i)) + SUM(in, ITRAN(in,gin)) + gsshr(gin)*SUM(i, SUB(i)+SUBE(i)+SUBM(i)) ;

$$EXP_{gin} = ggshr_{gin} * \sum_i (PQ_i * GD_i) + \sum_{in} ITRAN_{in,gin} + gsshr_{gin} * \sum_i (SUB_i + SUBE_i + SUBM_i)$$

4. OEXPEQ(nno).. EXP(nno) =E= SUM(in, ITRAN(in,nno)) ;

$$EXP_{nno} = \sum_{in} ITRAN_{in,nno}$$

5. SAVEQ(din).. SAV(din) =E= INC(din) - EXP(din) ;

$$SAV_{din} = INC_{din} - EXP_{din}$$

6. SAVINGEQ.. SAVING =E= SUM(in, SAV(in)) +sum(bank,CFLOW(bank)) ;

$$SAVING = \sum_{in} SAV_{in} + \sum_{bank} CFLOW_{bank}$$

7. ROWSAV.. FSAV*EXR =E= SUM(fr, SAV(fr)) ;

$$FSAV * EXR = \sum_{fr} SAV_{fr}$$

8. CDEQ(i).. CD(i) =E= SUM(h, alphaq(i,h)*YCONS(h))/PQ(i) ;

$$CD_i = \frac{\sum_h \alpha_{i,h} * YCON_h}{PQ_i}$$

9. DKEQ(i).. PK(i)*DK(i) =E= KSHR(i)*INVEST ;

$$PK_i * DK_i = KSHR_i * INVEST$$

10. IDEQ(i).. ID(i) =E= SUM(j, capmat(i,j)*DK(j)) ;

$$ID_i = \sum_j capmat_{i,j} * DK_j$$

11. INVESTEQ.. INVEST =E= SUM((i,in), INVES(i,in)) ;

$$INVEST = \sum_i \sum_{in} INVES_{i,in}$$

12. DOMINVEQ(i,fin).. INVES(i,fin) =E= lambda0(i,fin)*(VA(i)**lambda1(i))*((1+avgRN)**lambda2(i))*(EXR**lambda3(i)) ;

$$INVES_{i,fin} = \lambda_{i,fin} * VA_i^{\lambda_{i,fin}} * (1 + avgRN)^{\lambda_{i,fin}} * EXR^{\lambda_{i,fin}}$$

13. AVGREQ.. $\text{avgRN} = \text{E} = \text{SUM}((\text{as}, \text{in}), \text{RN}(\text{as}) * \text{AssetSLag}(\text{as}, \text{in})) / \text{SUM}((\text{as}, \text{in}), \text{AssetSLag}(\text{as}, \text{in}))$;

$$\text{avgRN} = \frac{\sum_{\text{as}} \sum_{\text{in}} \text{RN}_{\text{as}} * \text{AssetSLag}_{\text{as}, \text{in}}}{\sum_{\text{as}} \sum_{\text{in}} \text{AssetSLag}_{\text{as}, \text{in}}}$$

Market Clearing Block

1. EQUIL(i).. $Q(i) = \text{E} = \text{INTQ}(i) + \text{CD}(i) + \text{GD}(i) + \text{ID}(i) + \text{TTMX}(i) / \text{PQ}(i)$;

$$Q_i = \text{INTQ}_i + \text{CD}_i + \text{GD}_i + \text{ID}_i + \frac{\text{TTMX}_i}{\text{PQ}_i}$$

2. FMKTEQ(f).. $\text{FS}(f) = \text{E} = \text{SUM}(i, \text{FACDEM}(i, f))$;

$$\text{FS}_f = \sum_i \text{FACDEM}_{i,f}$$

3. UEMPEQ.. $\text{UEMP} = \text{E} = \text{LSUP} - \text{SUM}(f_l, \text{sum}(i, \text{FACDEM}(i, f_l)))$;

$$\text{UEMP} = \text{LSUP} - \sum_{f_l} \sum_i \text{FACDEM}_{i,f_l}$$

4. CAEQ(fr).. $\text{SAV}(fr) = \text{E} = (\text{SUM}(f, \text{factoin}(fr, f) * \text{YF}(f)) + \text{SUM}(in2, \text{ITRAN}(fr, in2)) + \text{mrshr}(fr) * \text{SUM}(i, \text{PWM}(i) * \text{EXR} * \text{M}(i))) - (\text{ershr}(fr) * \text{SUM}(i, \text{PWE}(i) * \text{EXR} * \text{E}(i)) + \text{SUM}(f, \text{YFROW}(f, fr)) + \text{SUM}(in, \text{ITRAN}(in, fr))) - \text{sum}(\text{bank}, \text{CFLOW}(\text{bank}))$;

$$\begin{aligned} \text{SAV}_{fr} = & (\sum_f (\text{factoin}_{fr,f} * \text{YF}_f) + \sum_{in2} \text{ITRAN}_{fr,in2} + \text{mrshr}_{fr} * \sum_i (\text{PWM}_i * \text{EXR} * \\ & \text{M}_i)) \\ & - (\text{ershr}_{fr} * \sum_i (\text{PWE}_i * \text{EXR} * \text{E}_i) + \sum_f \text{YFROW}_{f,fr} + \sum_{in} \text{ITRAN}_{in,fr}) \\ & - \sum_{\text{bank}} \text{CFLOW}_{\text{bank}} \end{aligned}$$

Gross National Product & Utility

1. GDPY.. $\text{GDP} = \text{E} = \text{SUM}(i, \text{PV}(i) * \text{VA}(i) + \text{INDTAX}(i) + \text{TARIFF}(i) - \text{SUB}(i) - \text{SUBM}(i))$;

$$\text{GDP} = \sum_i (\text{PV}_i * \text{VA}_i + \text{INDTAX}_i + \text{TARIFF}_i - \text{SUB}_i - \text{SUBM}_i)$$

2. GDPR.. $\text{RGDP} = \text{E} = \text{SUM}(i, \text{CD}(i) + \text{ID}(i) + \text{GD}(i)) + \text{SUM}(i, \text{E}(i)) - \text{SUM}(i, (1 - \text{TMREAL0}(i)) * \text{M}(i))$;

$$\text{RGDP} = \sum_i (\text{CD}_i + \text{ID}_i + \text{GD}_i + \sum_i \text{E}_i - \sum_i (1 - \text{TMREAL0}_i) * \text{M}_i)$$

Secondary Investment

FixANEQ.. $\text{SUM}(\text{firm}, \text{FixA}(\text{firm})) = \text{E} = \text{SUM}((i, \text{firm}), \text{INVES.L}(i, \text{firm})) + \text{SUM}(\text{firm}, (\text{jkl}(\text{firm}) * (\text{Sum}(\text{assec}, (\text{RNSEC.L} - \text{RNSEC0}) * \text{ASSET}(\text{assec}, \text{firm})) + \text{Sum}(\text{asmd}, (\text{RNMD.L} - \text{RNMD0}) * \text{ASSET}(\text{asmd}, \text{firm})) + \text{Sum}(\text{ascr}, (\text{RNCR.L} - \text{RNCR0}) * \text{ASSET}(\text{ascr}, \text{firm}))))$;

AssetNEQ.. $\text{Sum}((\text{as}, \text{firm}), \text{Asset}(\text{as}, \text{firm})) = \text{E} = \text{SUM}((\text{as}, \text{firm}), \text{Asset}(\text{as}, \text{firm})) - \text{FixAN} + \text{SUM}((i, \text{firm}), \text{INVES.L}(i, \text{firm}))$;

JK1EQ(firm).. jk1(firm)/(1-jk1(firm)) =E= pajk1*((1-RNCR)/(1+RNCR))**pbjk1 ;

Financial Block

1. AssetSQ(as,in).. AssetS(as,in) =E= AssetSLag(as,in) + Asset(as,in) ;

$$AssetS_{as,in} = AssetSLag_{as,in} + Asset_{as,in}$$

2. LiabSQ(in,as).. LiabS(in,as) =E= LiabSLag(in,as) + Liab(in,as) ;

$$LiabS_{in,as} = LiabSLag_{in,as} + Liab_{in,as}$$

3. FixASQ(in).. FixAS(in) =E= FixASLag(in) + FixA(in) ;

$$FixAS_{in} = FixASLag_{in} + FixA_{in}$$

4. WealthQ(in).. Wealth(in) =E= WealthLag(in) + WEALF(in) ;

$$Wealth_{in} = WealthLag_{in} + WEALF_{in}$$

5. FixAQ(in).. FixA(in) =E= SUM(i, INVES(i,in)) ;

$$FixA_{in} = \sum_i INVES_{i,in}$$

6. WEALFQ(in).. WEALF(in) =E= SAV(in) ;

$$WEALF_{in} = SAV_{in}$$

7. AsINBAL(in).. SUM(as, AssetS(as,in)) + FixAS(in) =E= SUM(as, LiabS(in,as)) + Wealth(in) ;

$$\sum_{as}(AssetS_{as,in}) + FixAS_{in} = \sum_{as}(LiabS_{in,as}) + Wealth_{in}$$

Composite Interest Rate

1. RNA1EQ(in)\$SUM(asdp, AssetSLag0(asdp,in)).. rna1(in) =E= SUM(asdp, rn(asdp)*AssetSLag(asdp,in)) / SUM(asdp, AssetSLag(asdp,in)) ;

$$rna1_{in} = (\sum_{asdp}(rn_{asdp} * AssetSLag_{asdp,in})) / (\sum_{asdp} AssetSLag_{asdp,in})$$

2. RNA2EQ(in)\$SUM(asgb, AssetSLag0(asgb,in)).. rna2(in) =E= SUM(asgb, rn(asgb)*AssetSLag(asgb,in)) / SUM(asgb, AssetSLag(asgb,in)) ;

$$rna2_{in} = (\sum_{asgb}(rn_{asgb} * AssetSLag_{asgb,in})) / (\sum_{asgb} AssetSLag_{asgb,in})$$

3. RNA3EQ(in)\$SUM(asec, AssetSLag0(asec,in)).. rna3(in) =E= SUM(asec, rn(asec)*AssetSLag(asec,in)) / SUM(asec, AssetSLag(asec,in)) ;

$$rna3_{in} = (\sum_{asec}(rn_{asec} * AssetSLag_{asec,in})) / (\sum_{asec} AssetSLag_{asec,in})$$

4. RNA4EQ(in)\$SUM(ascr, AssetSLag0(ascr,in)).. rna4(in) =E= SUM(ascr, rn(ascr)*AssetSLag(ascr,in)) / SUM(ascr, AssetSLag(ascr,in)) ;

$$rna4_{in} = (\sum_{ascr}(rn_{ascr} * AssetSLag_{ascr,in})) / (\sum_{ascr} AssetSLag_{ascr,in})$$

5. RNA5EQ(in)\$SUM(aseq, AssetSLag0(aseq,in)).. rna5(in) =E= SUM(aseq, rn(aseq)*AssetSLag(aseq,in)) / SUM(aseq, AssetSLag(aseq,in)) ;

$$rna5_{in} = (\sum_{aseq}(rn_{aseq} * AssetSLag_{aseq,in})) / (\sum_{aseq} AssetSLag_{aseq,in})$$

FOREX Reserve

FINALEQ(asfxx).. AssetS(asfxx,"PRIV") =E= LiabS("ROW1",asfxx) ;

$$AssetS_{asfxx,PRIV} = LiabS_{ROW1,asfxx}$$

AssetS.FX(asfxx,in) = AssetS.L(asfxx,in) ;
 LiabS.FX(in,asfxx) = LiabS.L(in,asfxx) ;
 LiabS.LO("ROW1",asfxx) = -INF ; LiabS.UP("ROW1",asfxx) = +INF ;
 RN.FX(asfxx) = RN.L(asfxx) ;

EQ: Asset ==> Liab

1. AST1AQ(ast1,in).. AssetS(ast1,in) =E=
 theta1(ast1,in)*(rn(ast1)/rn0(ast1))**sigma1(ast1,in) ;

$$AssetS_{ast1,in} = theta1_{ast1,in} * \left(\frac{rn_{ast1}}{rn0_{ast1}} \right)^{sigma1_{ast1,in}}$$

2. AST1SH(in,ast1).. LiabS(in,ast1) =E= ast1shr(in,ast1)*SUM(in2, AssetS(ast1,in2))
 ;

$$LiabS_{in,ast1} = ast1shr_{in,ast1} * \sum_{in2} AssetS_{ast1,in2}$$

RN.FX(ast1) = RN.L(ast1) ;

EQ: Asset <= Liab

1. AST2AQ(in,ast2).. LiabS(in,ast2) =E=
 theta2(in,ast2)*(rn(ast2)/rn0(ast2))**sigma2(in,ast2) ;

$$LiabS_{in,ast2} = theta2_{in,ast2} * \left(\frac{rn_{ast2}}{rn0_{ast2}} \right)^{sigma2_{in,ast2}}$$

2. AST2SH(ast2,in).. AssetS(ast2,in) =E= ast2shr(ast2,in)*SUM(in2, LiabS(in2,ast2)) ;

$$AssetS_{ast2,in} = ast2shr_{ast2,in} * \sum_{in2} LiabS_{in2,ast2}$$

RN.FX(ast2) = RN.L(ast2) ;

EQ: Asset == Liab

1. ASTEEQ(aste).. LiabS("GOV1",aste) =E=
 theta2("GOV1",aste)*(rn(aste)/rn0(aste))**sigma2("GOV1",aste) ;

$$LiabS_{GOV1,aste} = theta2_{GOV1,aste} * \left(\frac{rn_{aste}}{rn0_{aste}} \right)^{sigma2_{GOV1,aste}}$$

AssetS.FX(aste,in) = AssetS.L(aste,in) ;
 LiabS.LO(in,aste) = -INF ; LiabS.UP(in,aste) = +INF ;
 RN.LO(aste) = -INF; RN.UP(aste) = +INF ;

EQ: Balancing Asset

1. ASTQEQ(astq).. SUM(in, LiabS(in,astq)) =E= SUM(in, AssetS(astq,in)) ;

$$\sum_{in} LiabS_{in,astq} = \sum_{in} AssetS_{astq,in}$$

LiabS.FX(in,astq) = LiabS.L(in,astq) ;
 AssetS.FX(astq,in) = AssetS.L(astq,in) ;
 AssetS.LO(astq,"PRIV") = -INF ; AssetS.UP(astq,"PRIV") = +INF ;

RN.FX(astq) = RN.L(astq) ;

Currency and Demand Deposit Block

1. MONEYD(in).. MD(in) =E= (alpha1(in))*(INC(in)**alpha2(in))*(rnv1(in)**(-alpha3(in))) ;

$$MD_{in} = \alpha_{1in} * (INC_{in}^{\alpha_{2in}}) * (rnv1_{in}^{-\alpha_{3in}})$$

2. RNV1EQ(in).. rnv1(in) =E= SUM(nasmd, rn(nasmd)*AssetSLag(nasmd,in)) / SUM(nasmd, AssetSLag(nasmd,in)) ;

$$tnv1_{in} = (\sum_{nasmd} (rn_{nasmd} * AssetSLag_{nasmd,in})) / (\sum_{nasmd} AssetSLag_{nasmd,in})$$

3. MDEQ(asmd,in).. AssetS(asmd,in) =E= mdshare(asmd,in)*MD(in) ;

$$AssetSLag_{asmd,in} = mdshare_{asmd,in} * MD_{in}$$

4. MSSHR(in,asmd).. LiabS(in,asmd) =E= mdshr(in,asmd)*SUM(in2, AssetS(asmd,in2)) ;

$$LiabS_{in,asmd} = mdshr_{in,asmd} * (\sum_{in2} AssetS_{asmd,in2})$$

RN.FX(asmd) = RN.L(asmd) ;

CCEQ.. CC =E= SUM((ascc,in),ASSETS(ascc,in)) / SUM((asmd,in),ASSETS(asmd,in));
 MULTEQ.. MULT =E= 1/(CC+(rr*(1-CC))) ;
 MDINEQ(in).. MDIN(in) =E= SUM(asmd, AssetS(asmd,in));
 M2DEQ.. M2D =E= SUM(in,MDIN(in))+SUM((asdp,in),ASSETS(asdp,in));
 M2SEQ.. M2S =E= MULT*RM ;
 M2EQILEQ.. M2S =E= M2D;
 MDEQ1(in).. MDIN(in)=E=MD(in);

Tobin

Portfolio allocation #####
 GH1EQ(rh).. gh1(rh)/(1-gh1(rh)) =E= phi1(rh)*((1+RNDP)/(1+RNNDP))*esph1(rh);
 GH3EQ(urrh).. gh3(urrh)/(1-gh3(urrh)) =E= phi3(urrh)*((1+RNEQ)/(1+RNNEQ))*esph3(urrh);
 ##### Calculating RN #####
 RNFXREQ.. RNFXR =E= SUM((asfxx,in), RN(asfxx)*ASSET(asfxx,in)) / SUM((asfxx,in), ASSET(asfxx,in))
 RNCREQ.. RNCR =E= SUM((ascr,in), RN(ascr)*ASSET(ascr,in)) / SUM((ascr,in), ASSET(ascr,in))
 RNSECEQ.. RNSEC =E= SUM((assec,in), RN(assec)*ASSET(assec,in)) / SUM((assec,in), ASSET(assec,in)) ;
 RNDPEQ.. RNDP =E= SUM((asdp,in), RN(asdp)*ASSET(asdp,in)) / SUM((asdp,in), ASSET(asdp,in));
 RNEQE.. RNEQ =E= SUM((aseq,in), RN(aseq)*ASSET(aseq,in)) / SUM((aseq,in), ASSET(aseq,in));
 RNSBIEQ.. RNSBI =E= SUM((assbi,in), RN(assbi)*ASSET(assbi,in)) / SUM((assbi,in), ASSET(assbi,in));
 RNGBEQ.. RNGB =E= SUM((asgb,in), RN(asgb)*ASSET(asgb,in)) / SUM((asgb,in), ASSET(asgb,in));
 RNNEQE.. RNNEQ =E= (SUM((assec,in), RN(assec)*ASSET(assec,in))+SUM((asgb,in), RN(asgb)*ASSET(asgb,in)))/(SUM((assec,in), ASSET(assec,in))+SUM((asgb,in), ASSET(asgb,in)));
 RNNDPEQ.. RNNDP =E= (SUM((aseq,in), RN(aseq)*ASSET(aseq,in))+SUM((assec,in), RN(assec)*ASSET(assec,in))+SUM((asgb,in), RN(asgb)*ASSET(asgb,in)))/(SUM((aseq,in), ASSET(aseq,in))+SUM((assec,in), ASSET(assec,in))+SUM((asgb,in), ASSET(asgb,in)));
 ##### Assets Allocation #####
 HDPEQ(rh).. Sum(asdp, Asset(asdp,rh)) =E= gh1(rh)*(WEALH(rh)-MDH(rh)-FIXA(rh))

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-Sum(asgb,ASSET(asgb,rh))-Sum(ascr,ASSET(ascr,rh))-Sum(assbi,ASSET(assbi,rh))-
Sum(aso,ASSET(aso,rh));
HEQEQ(rh).. Sum(aseq, Asset(aseq,rh)) =E= gh3(rh)*(1-gh1(rh))*(WEALH(rh)-
MDH(rh) -FIXA(rh) -Sum(asgb,ASSET(asgb,rh))- Sum(ascr,ASSET(ascr,rh))-
Sum(assbi,ASSET(assbi,rh))-Sum(aso,ASSET(aso,rh)));
HSECEQ(rh).. Sum(asec, Asset(asec,rh)) =E= (1-gh3(rh))*(1-gh1(rh))*(WEALH(rh)-
MDH(rh) -FIXA(rh) -Sum(asgb,ASSET(asgb,rh))-Sum(ascr,ASSET(ascr,rh))-
Sum(assbi,ASSET(assbi,rh))-Sum(aso,ASSET(aso,rh)));
##### Balance Sheet Equations #####
IDHHEQ(h).. WEALH(h) =E= Sum(as,ASSET(as,h))+FIXA(h);
IDGOVEQ(gin).. WEALGOV(gin) =E= Sum(as,ASSET(as,gin))+FIXA(gin);
IDCBEQ(cbank).. WEALCB(cbank) =E= Sum(as,ASSET(as,cbank))+FIXA(cbank);
IDBANKEQ(bank).. WEALBANK(bank) =E= Sum(as,ASSET(as,bank))+FIXA(bank);
IDFIRMEQ(firm).. WEALFIRM(firm) =E= Sum(as,ASSET(as,firm))+FIXA(firm);
IDROWEQ(fr).. WEALROW(fr) =E= Sum(as,ASSET(as,fr))+FIXA(fr);

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Poverty Line

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PDAVGEQ.. PDAVG =E= SUM(i,PD(i)*D(i))/SUM(i,D(i));
POVEQ(ph).. PL(ph) =E= (PINDEX/PDAVG)*SUM(i,alphapov(i,ph)*PD(i));
TOTPOVEQ.. PLTOT =E= (PINDEX/PDAVG)*SUM(i,alphapovt(i)*PD(i));

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Migration

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1. MIGEQ(f1,f1).. MIGMATR(f1,f1) =E=
gamma0(f1)*(((SUM(i,FACDEM(i,f1))/SUM(i,FACDEM0(i,f1)))/(SUM(i,FACDEM(i,f1))/SUM(i,F
ACDEM0(i,f1)))))*GAMMA1(f1));
2. MIGEQ1(f1).. SUM(ff1, MIG(f1,f1)) =E= SUM(ff1, LSUP0*(MIGMATR(f1,f1)-
ONE(f1,f1)));
3. MIGEQEQ.. SUM(ff1, SUM(f1, MIG(f1, f1))) =E= SUM(f1, SUM(ff1,
MIG(f1,f1)));

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Static Credit Channel

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1. Bank's Safe Asset
BB1EQ.. BB1 =E=
SUM((assbi,bank),ASSETS(assbi,bank))/SUM((as,bank),ASSETS(as,bank))+SUM((asgb
,bank),ASSETS(asgb,bank))/SUM((as,bank),ASSETS(as,bank));

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2. Bank's Availalble fund
BANKFEQ.. BANKF =E= (1-BB1)*SUM((as,bank),ASSETS(as,bank));

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3. Static Credit Channel
BANKLOANEQ.. BANKLOAN =E=
ss*(BANKF*((sum(firm,WEALF(firm))/(SUM((as,firm),ASSET(as,firm))+
sum(firm,FIXA(firm))))**ss1)
*((SUM((asgb,bank),ASSETS(asgb,bank))/(SUM((as,bank),ASSETS(as,bank))+
SUM(bank,FIXA(bank))))**ss2)
*((SUM((assbi,bank),ASSETS(assbi,bank))/(SUM((as,bank),ASSETS(as,bank))+
SUM(bank,FIXA(bank))))**ss2)
*((SUM(bank,WEALF(bank))/(SUM((as,bank),ASSET(as,bank))+
SUM(bank,FIXA(bank))))**ss3));

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4. Bank's loan = Bank's credit asset
SECLOANEQ.. BANKLOAN =E= SUM((ascr,bank),Asset(ascr,bank));

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```

5. Bank-led Inflow (CFLOW)
CLIAEQ(bank).. SUM(as,Liab(bank,as))=E= sum(as,Liab.L(bank,as))+CFLOW(bank);

```


Dynamic Credit Channel

```

1. WEALFF.L(firm)$ (years(t) ge 2) = (EXR0/EXR.L)*WEALF.L(firm);

2. BANKLOAN.L$ (years(t) ge 2) =
ss*(BANKF.L*((sum(firm,WEALFF.L(firm))/(SUM((as,firm),ASSET.L(as,firm))+
sum(firm,FIXA.L(firm))))**ss1)
*((SUM((asgb,bank),ASSETS.L(asgb,bank))/(SUM((as,bank),ASSETS.L(as,bank))+
SUM(bank,FIXA.L(bank))))**ss2)
*((SUM((assbi,bank),ASSETS.L(assbi,bank))/(SUM((as,bank),ASSETS.L(as,bank))+
SUM(bank,FIXA.L(bank))))**ss2)
*((SUM(bank,(EXR0/EXR.L)*WEALF.L(bank))/(SUM((as,bank),ASSET.L(as,bank))+
SUM(bank,FIXA.L(bank))))**ss3));

3. BANKLOAN.L$ (years(t) ge 2) = SUM((ASCR,BANK),ASSET.L(ASCR,BANK)) ;

```

Equation of Motion

```

1. KSTOCK.L$ (years(t) ge 2) = (1-DEPREC)*FS.L("FACT2") + 0.1*sum(i,DK.L(i));
2. FS.FX("FACT2")$ (years(t) ge 2) = KSTOCK.L ;

```

PARAMETERS

| | |
|------------------|--|
| alpha2(in) | EXPONENT FOR INCOME IN MONEY DEMAND FUNCTION |
| alpha3(in) | EXPONENT FOR INTEREST RATE IN MONEY DEMAND FUNCTION |
| alphah(h) | HOUSEHOLD MONEY DEMAND PARAMETER |
| aad(i,j) | DOMESTIC GOOD I-O COEFFICIENT |
| aaf(i,j) | IMPORTED GOOD I-O COEFFICIENT |
| ai(i) | OUTPUT PARAMETER |
| alpha1(in) | MONEY DEMAND PARAMETER |
| alphapov(i,ph) | CONSUMPTION PATTERN MATRIX |
| alphapovt(i) | TOTAL CONSUMPTION PATTERN MATRIX |
| alphaq(i,h) | C-D EXPONENT IN CONSUMER DEMAND FOR COMPOSITE GOODS |
| aq(i) | COMMODITY PARAMETER |
| ast1shr(in,ast1) | ASSET SHARE PARAMETER FOR AST1 |
| ast2shr(ast2,in) | ASSET SHARE PARAMETER FOR AST2 |
| astqshr(in,astq) | ASSET SHARE PARAMETER FOR ASTQ |
| at(i) | INTERMEDIATE INPUTS PARAMETER |
| av(i) | VALUE-ADDED PARAMETER |
| avx(i) | PRODUCTIVITY DISTORTION |
| ax(i) | OUTPUT PARAMETER |
| bi(i) | OUTPUT PARAMETER |
| bmh0(h) | FINANCIAL ELASTICITY PARAMETER |
| bmh1(h) | EXPONENT FOR DIRECT TAX FROM HOUSEHOLDS |
| bmh2(h) | EXPONENT FOR DEMAND DEPOSIT |
| bmh3(h) | EXPONENT FOR PRICE INDEX |
| bq(i) | COMMODITY PARAMETER |
| bt(i) | INTERMEDIATE INPUTS PARAMETER |
| bv(i,f) | VALUE-ADDED PARAMETER |
| bx(i) | OUTPUT PARAMETER |
| capmat(i,j) | CAPITAL MATRIX |
| DEPREC | CAPITAL DEPRECIATION |
| dtax(gin,din) | DIRECT TAX (from domestic institution to the government) |
| ershr(fr) | EXPORT SHARE OF ROWS BY EXPORTED COMMODITY |
| esph1(h) | RISK PARAMETER FOR DEMAND DEPOSIT |
| esph3(h) | RISK PARAMETER FOREQUITY |

| | |
|------------------|--|
| factoin(in,f) | ALLOCATION MATRIX--FACTORS TO INSTITUTION'S INCOME |
| GAMMA0(f) | COEFFICIENT OF MIGRATION |
| GAMMA1(f) | ELASTICITY OF MIGRATION |
| ggshr(gin) | Government agency share of Expenditure |
| gishr(gin) | Government agency share of collected indirect tax |
| gsshr(gin) | Government agency share of subsidy paid |
| impf(i) | IMPERFECT DISTORTION |
| kshr(i) | CAPITAL INVESTMENT SHARE |
| lambda0(i,firm) | FIRM INVESTMENT PARAMETER |
| lambda1(i) | EXPONENT FOR BUSINESS CYCLE |
| lambda2(i) | EXPONENT FOR INTEREST RATE |
| lambda3(i) | EXPONENT FOR EXCHANGE RATE |
| lgrow(f) | GROWTH RATE OF LABOR FORCE (LABOR SUPPLY) |
| lnshare | LOAN SHARE OF FIRMS |
| mdshare(asmd,in) | MONEY SHARE TO MONEY |
| mdshr(in,asmd) | MONEY SHARE FROM MONEY |
| MIG0(F,FF) | INITIAL MIGRATION |
| MIGMATR0(f,ff) | MATRIX OF MIGRATION |
| mrshr(fr) | Import share of ROWs by imported commodity |
| ONE(f,ff) | PARAMETER FOR MIGRATION |
| pajkl | SECONDARY INVESTMENT PARAMETER |
| pbjkl | EXPONENT FOR CREDIT INTEREST RATE |
| PDAVG0 | AVERAGE DOMESTIC PRICE |
| phi(i) | WAGE FUNCTION ELASTICITY OF AVG PRODUCTIVITY |
| phih1(h) | TOBIN PARAMETER FOR HOUSEHOLD DEPOSIT |
| phih3(h) | TOBIN PARAMETER FOR HOUSEHOLD EQUITY |
| PL0(ph) | POVERTY LINE |
| PLTOT0 | POVERTY LINE OF SOCIETY |
| psube(i) | EXPORT SUBSIDY Share |
| psubm(i) | IMPORT SUBSIDY Share |
| rhoi(i) | EXPONENT FOR OUTPUT (X) PRODUCTION FUNCTION |
| rhoq(i) | EXPONENT FOR ARMINGTON FUNCTION |
| rhot(i) | EXPONENT FOR CES FUNCTION |
| rhov(i) | EXPONENT FOR VALUE ADDED FUNCTION |
| rhox(i) | EXPONENT FOR CET FUNCTION |
| sigma1(as,in) | FINANCIAL BALANCE |
| sigma2(in,as) | FINANCIAL BALANCE |
| ss | BANK LOAN PARAMETER |
| ss1 | EXPONENT FOR FIRM'S WEALTH |
| ss2 | EXPONENT FOR BANK'S SAFE ASSET |
| ss3 | EXPONENT FOR BANK'S WEALTH |
| subr(i) | SUBSIDY Share PARAMETER (i.e. SUB(i) = subr(i)*EXP(gov) |
|) | |
| sumcapmat(i) | TOTAL ROW OF CAPITAL MATRIX |
| tdom(i) | INDIRECT DOMESTIC TAX RATES |
| thetal(as,in) | FINANCIAL BALANCE |
| theta2(in,as) | FINANCIAL BALANCE |
| tm(i) | TARIFF RATES ON IMPORTS |
| ttd(i) | DOMESTIC TRADE AND TRANSPORT MARGINS |
| ttf(i) | IMPORTED TRADE AND TRANSPORT MARGINS |
| ttx(i) | TTM coefficient (received) |
| vp(i) | WAGE FUNCTION ELASTICITY OF PINDEX |
| wlshare(i,fl) | SECTORAL WEIGHT OF LABOR WAGES |

VARIABLES

| | |
|------------------|---|
| Ashare(as,in) | SHARE OF ASSET STOCK VALUE |
| Asset(as,in) | ASSET (FLOW) VALUE |
| AssetS(as,in) | ASSET STOCK VALUE (END-OF-PERIOD) |
| AssetSLag(as,in) | ASSET STOCK VALUE (BEGINNING-OF-PERIOD) |

| | |
|-----------------|--|
| avgRN | AVG INTEREST RATE |
| BANKF | BANK AVAILABLE FUND |
| BANKLOAN | BANK LOAN FROM BANKS |
| BB1 | SHARE OF SBI IN BANK FUNDS |
| CC | COEFFICIENT OF CURRENCY TO MONEY DEMAND |
| CD(i) | INITIAL PRIVATE CONSUMPTION DEMAND |
| CFLOW(bank) | FOREIGN CAPTIAL |
| D(i) | INITIAL DOMESTIC GOOD SOLD DOMESTICALLY |
| DINTM(i) | INITIAL DOMESTIC INTERMEDIATE INPUT |
| DIRTAX(gin,din) | INITIAL DIRECT-INCOME TAX |
| DK(i) | INITIAL QUANTITY OF CAPITAL BY SECTOR OF DESTINATION |
| DTTM(i) | INITIAL TRADE & TRANSPORT MARGIN ON IMPORT (PAID) |
| E(i) | INITIAL EXPORT QUANTITY |
| EXPD(in) | EXPENDITURE |
| EXR | INITIAL EXCHANGE RATE |
| FACDEM(i,f) | INITIAL FACTOR DEMAND |
| FDISTLH | FINANCIAL DISTRIBUTION BETWEEN RICH AND POOR |
| FINTM(i) | INITIAL IMPORTED INTERMEDIATE INPUT |
| FixA(in) | FIXED ASSET (FIXED INVESTMENT) |
| FixAN | FIRM'S FIXED ASSET (SECONDARY) |
| FixAS(in) | FIXED ASSET STOCK VALUE (END-OF-PERIOD) |
| FixASLag(in) | FIXED ASSET STOCK VALUE (BEGINNING-OF-PERIOD) |
| FOREXM2 | M2/RESERVE |
| FS(f) | INITIAL FACTOR SUPPLY |
| FSAV | INITIAL ROW SAVING IN FOREIGN CURRENCY |
| FTTM(i) | INITIAL TRADE & TRANSPORT MARGIN ON IMPORT (PAID) |
| GD(i) | INITIAL GOVT CONSUMPTION DEMAND |
| GDP | INITIAL GDP |
| GTRAN(in,in2) | INITIAL INSTITUTIONAL TRANSFERS (to gov or direct tax) |
| ID(i) | INITIAL INVESTMENT DEMAND |
| IMPERFECT(i) | INITIAL IMPERFECT COMPETITION DISTORTION |
| INC(in) | Institution's Revenue ^ Income ^ Receipt |
| INDTAX(i) | INITIAL TOTAL INDIRECT TAX |
| INTM(i) | INITIAL INTERMEDIATE COMPOSITE |
| INTQ(i) | INITIAL SUPPLY OF INTERMEDIATE Goods or Services |
| INVES(i,in) | INVESTMENT |
| INVEST | INITIAL TOTAL INVESTMENT |
| ISGAP | INCOME SAVING GAP |
| ITRAN(in,in2) | INITIAL INSTITUTIONAL TRANSFERS (Total) |
| ITRANB(h,gin) | INITIAL INSTITUTIONAL TRANSFERS (to gov from households) |
| IY | HOUSEHOLD INVESTMENT |
| jk1(firm) | ALLOCATING FINANCIAL LIQUID ASSETS INTO REAL SECTOR |
| INVESTMENT | |
| KSTOCK | CAPITAL STOCK |
| Liab(in,as) | LIABILITY (FLOW) VALUE |
| LiabS(in,as) | LIB STOCK VALUE (END-OF-PERIOD) |
| LiabSLag(in,as) | LIAB STOCK VALUE (BEGINNING-OF-PERIOD) |
| Lshare(in,as) | SHARE OF LIAB STOCK VALUE |
| LSUP | LABOR SUPPLY (TOTAL) |
| M(i) | INITIAL IMPORT QUANTITY |
| M2D | M2 SUPPLY |
| M2S | M2 DEMAND |
| MD(in) | Money Demand |
| MDH(h) | MONEY DEMAND OF HOUSEHOLDS (FLOW) |
| MDIN(in) | MONEY DEMAND OF INSTITUTIONS (FLOW) |
| MIG(f,ff) | MIGRATION |
| MIGMATR(F,FF) | MIGRATION MATRIX |
| MPS(h) | INITIAL MARGINAL PROPENSITY TO SAVE |
| MULT | RESERVE REQUIREMENT |
| OTRAN(in,in2) | INITIAL INSTITUTIONAL TRANSFERS (others) |
| PD(i) | INITIAL PRICE OF D |
| PDAVG | AVERAGE DOMESTIC PRICE |

| | |
|----------------|---|
| PDINTM(i) | INITIAL PRICE OF DOMINTM |
| PDL(i) | INITIAL SECTORAL AVG PRODUCTIVITY |
| PE(i) | INITIAL PRICE OF E |
| PFINTM(i) | INITIAL PRICE OF FORINTM |
| PINDEX | INITIAL PRICE INDEX |
| PINTM(i) | INITIAL PRICE OF INTM |
| PK(i) | INITIAL PRICE OF CAPITAL BY SECTOR OF DESTINATION |
| PL(ph) | POVERTY LINE |
| PLTOT | POVERTY LINE OF SOCIETY |
| PM(i) | INITIAL PRICE OF M |
| PQ(i) | INITIAL PRICE OF Q |
| PV(i) | INITIAL PRICE OF VA |
| PWE(i) | INITIAL WORLD PRICE OF EXPORTS |
| PWM(i) | INITIAL WORLD PRICE OF IMPORTS |
| PX(i) | INITIAL PRICE OF X |
| Q(i) | INITIAL COMPOSITE GOOD QUANTITY |
| RER | REAL EXCHANGE RATE |
| RGDP | INITIAL REAL GDP |
| RM | MONEY MULTIPLIER |
| RN(as) | RATE OF RETURN ON ASSET |
| rna1(in) | FINANCIAL RETURN ON DEPOSIT |
| rna2(in) | FINANCIAL RETURN ON GOVERNMENT BOND |
| rna3(in) | FINANCIAL RETURN ON SECURITIEIS |
| rna4(in) | FINANCIAL RETURN ON CREDIT |
| rna5(in) | FINANCIAL RETURN ON EQUITY AND SHARE |
| RNCR | RETURN ON CREDIT |
| RNDP | RETURN ON DEPOSIT |
| RNEQ | RETURN ON EQUITY AND SHARE |
| RNFXR | RETURN ON FOREX |
| RNGB | RETURN ON GOVERNMENT BOND |
| RNLag(as) | LAG of RN |
| RNNDP | RETURN ON NON-DEPOSIT |
| RNNEQ | RETURN ON NON-EQUITY AND SHARE |
| RNSBI | RETURN ON CENTRAL BANK CERTIFICATE |
| RNSEC | RETURN ON SECURITIES |
| RNshare(in) | SHARE OF ASSETS IN INSTITUTION |
| rnv1(in) | AVERAGE INTRESTRATE #1 (NON-MONEY) |
| RTRAN(in,in2) | INITIAL INSTITUTIONAL TRANSFERS (financial returns) |
| SAV(in) | INSTITUTION'S SAVING |
| SAVDOM | DOMESTIC SAVING |
| SAVING | INITIAL TOTAL SAVING |
| SECLOAN | BANK LOAN |
| SUB(i) | INITIAL SECTORAL SUBSIDY |
| SUBE(i) | SUBSIDY FOR EXPORT |
| SUBM(i) | SUBSIDY FOR IMPORT |
| SY | HOUSEHOLD SAVINGS |
| TARIFF(i) | INITIAL TARIFF |
| TAssetS(in) | TOTAL ASSET STOCK VALUE |
| TLiabS(in) | TOTAL LIAB STOCK VALUE |
| TMREALV(i) | TTM REAL TERMS INITIAL VALUE |
| TAssetS(as) | TOTAL ASSET STOCK VALUE |
| TTLiabS(as) | TOTAL LIABILITY STOCK |
| TTM(i) | INITIAL TRADE & TRANSPORT MARGIN (PAID) |
| TTMX(i) | INITIAL TRADE & TRANSPORT MARGIN (RECEIVED) |
| UEMP | UNEMPLOYMENT (TOTAL) |
| UEMPR | UNEMPLOYMENT RATE |
| VA(i) | INITIAL VALUE-ADDED |
| WAGES(i) | INITIAL SECTORAL WAGE |
| WDISTLH | WEALTH DISTIRBUTION BETWEEN RICH AND POOR |
| WEALBANK(bank) | BANK'S WEALTH |
| WEALCB(cbank) | CENTRAL BANK'S WEALTH |
| WEALF(in) | FLOW OF WEALTH |

| | |
|----------------|--|
| WEALFF(firm) | FIRM'S WEALTH THAT IS AFFECTED BY THE EXR |
| WEALFIRM(firm) | FIRM'S WEALTH |
| WEALGOV(gin) | GOVERNMENT'S WEALTH |
| WEALH(h) | HOUSEHOLD'S WEALTH |
| WEALROW(fr) | FOREIGN WEALTH |
| Wealth(in) | WEALTH STOCK VALUE (END-OF-PERIOD) |
| WealthLag(in) | LAG OF WEALTH STOCK VALUE |
| WF(f) | INITIAL FACTOR PRICE |
| WFDIST(i,f) | INITIAL FACTOR PRICE SECTORAL PROP RATIOS |
| wtq(i) | WEIGHT FOR CPI |
| X(i) | INITIAL DOMESTIC OUTPUT |
| YCONS(h) | INITIAL CONSUMPTION BY HOUSHOLDS |
| YDISTLH | INCOME DISTRIBUTION BETWEEN RICH AND POOR |
| YDISTRU | INCOME DISTRIBUTION BETWEEN RURAL AND URBAN |
| YF(f) | INITIAL FACTOR INCOME |
| YFROW(f,FR) | DOMESTIC'S EARNING ABROAD(ROW TO FACTORS) IN FOREIGN |
| CURRENCY | |

BIBLIOGRAPHY

Akerlof, G. A., and Shiller R.J., 2009: *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matter for Global Capitalism*, Princeton University Press

Allen. M. et al.,2002: “A Balance Sheet Approach to Financial Crisis”. IMF Working Paper No. 210, December

Annabi. A. et al, 2006: “Functional Forms and Parameterization of CGE models”, MPIA Working Paper 04, March

Azis. I. J., 2000: “Simulating Economy-wide Models to Capture the Transition from Financial Crisis to Social Crisis”, *The Annals of Regional Science*, Vol.34, pp251-278

Azis, I. J., 2004: “Modeling the Disconnect Between Financial policy and Real Sector Using the Financial Social Accounting Matrix as a Data System: The Case of Indonesia”, paper presented in conference on ‘Banking Disintermediation and Its Implication to Monetary policy: Theoretical Views and Countries’ Experiences’, by PPSK-Bank Indonesia, Dec 15-16, Bali.

Azis, I.J.,. 2008: *Macroeconomic Policy and Poverty*. ADBI Discussion Paper 111. Tokyo: Asian Development Bank Institute.

Azis, I., 2010: Lecture note, CRP6220, Spring 2010

Azis, I., 2010: Lecture note, NBA5950, Spring 2010

Azis, I., 2010: Lecture note, NBA5240, Spring 2010

Azis, I., 2010: “Predicting a Recovery Date from the Economic Crisis of 2008”, *Socio-Economic Planning Sciences*, Vol. 44, pp. 122-129

Azis, I. J., 2012: “Entering the Uncharted Territory”, The Research Institute of Economy, Trade and Industry (RIETI).

Battiston. S. et al., 2007: “Credit Chains and Bankruptcy Propagation in Production Networks”, *Journal of Economic Dynamics & Control*, Vol 31, pp2061-2084

Bernanke, B. S., and Blinder A.S., (1988). "Credit, Money, and Aggregate Demand," *American Economic Review*, vol. 78, Papers and Proceedings of the 100th Annual Meeting of the American Economics Association, May, pp. 435-39.

Bernanke, B. S., and Gertler. M., 1995: "Inside the Black Box: The Credit Channel of Monetary Policy Transmission," *Journal of Economic Perspectives*, vol. 9 (Fall), pp. 27-48.

Boldin, M.,1994: “Econometric Analysis of the Recent downturn in Housing: Was it a Credit Crunch?” Federal Reserve Bank of New York, memo

Borensztein, E. and Lee, J. W., 2002: “Financial Crisis and Credit Crunch in Korea: Evidence from Firm-level data”, *Journal of Monetary Economics* 49, pp. 853-857.

Bruno, V., and Shin, H.S., 2013: “Assessing Macroprudential Policies: Case of Korea”, NBER Working Paper No. 19084, May.

Hester. D., and Tobin. J, 1967: *Financial Markets and Economic Activity*,

Cowles Foundation Monograph 21, New York: Wiley

Goldfajn. I., and Baig. T., 1998: “ Monetary Policy in the Aftermath of Currency Crises: The Case of Asia”, IMF Working Paper 170.

Greenwald. B. C., Stiglitz. J. E., and Weiss. A., 1984: “Informational Imperfections in the Capital Market and Macroeconomic Fluctuations”, The American Economic Review, Vol.74, No 2, Papers and Proceedings of the Ninety-Sixth Annual Meeting of the American Economic Association, May, pp. 194-199.

Greenwald. B. C., and Stiglitz. J. E., 1993: “Financial Market Imperfections and Business Cycles”, The Quarterly Journal of Economics, Vol 108, No1, pp. 77-114

Catao. L.,Laxton. D., and Pagan. A., 2008: “Monetary Transmission in an Emerging Targeter: The Case of Brazil”, IMP Working Paper 191

Ferri, G. and Kang, T. S.,1999: “ The Credit Channel at Work: Lessons from the Republic of Korea’s Financial Crisis”, Policy Research Working Paper, World Bank

Forbes, K. J., and Warnock, F. E., 2012: “Debt and Equity-led Capital Episodes”, NBER Working Paper 18329, August.

Kim, Changsoo, 2013: “Macroprudential Policies: Korea’s Experiences”, Presented at the Rethinking Macro Policy II: First Steps and Early Lessons Conference hosted by IMP, Washington, April 16-17.

Kim, H.E., 1998: "A Credit Channel as the Key Transmission Mechanism

Underlying the Recent Financial Crisis in Korea", *World Bank, mimeo*, November, Washington DC.

Kim, H.E., 1999: "Was Credit Channel a Key Monetary Transmission Mechanism Following the Recent Financial Crisis in the Republic of Korea", *World Bank Policy Research Working Paper*, April, Washington DC.

Larrain, G., Reisen, H., and Maltzan, J. V., 1997: "Emerging Market Risk and Sovereign Credit Ratings", Working Paper 124, OECD Development Centre, April

Masi G. M. et al, 2011: "An Analysis of the Japanese Credit Network", *Evolutionary and institutional economics review*, Vol. 7, pp. 209-232

Robinson, S., 1991: "Macroeconomic, Financial Variables, and Computable General Equilibrium Models", *World Development*, Vol. 19, No.11, pp. 1509-1525.

Shin, H.S., and Shin, K., 2010: "Bank Regulation and Capital Inflows: An Emerging Market Perspective", Presented at 'Reshaping Global Economic Governance and the Role of Asia in G20' ADB/Peterson Institute Conference, Washington DC, April 20th

Simorangkir. I., and Adamanti. J., 2010: "The Role of Fiscal Stimulus and Monetary Easing in Indonesian Economy during Global Financial Crisis: Financial Computable General Equilibrium Approach", *bulletin of Monetary, Economics and Banking*, Oct, pp165-186

Stiglitz, J. E. and Greenwald, B., 2003: "Towards a New Paradigm in Monetary Economics", Cambridge.

Stiglitz, J. E., 2013: "The Price of Inequality: How Today's Divided Society Endangers Our Future", W.W. Norton & Company.

Stiglitz, J. E., 2001: “Principles of Financial Regulation: A Dynamic Portfolio Approach”, *The World Bank research Observer*, Vol16, no.1 (Spring), ABI/INFORM Global.

Stiglitz, J. E., and Weiss, A., 1981: “Credit Rationing in Markets with Imperfect Information”, *The American Economic Review*, Vol 71, Issue 3 (Jun), pp. 393-410.

Storm, S., 1994: “The Macroeconomic Impact of Agricultural Policy: A CGE Analysis for India, *Journal of Policy Modeling*, Vol. 16, no.1, pp.55-95

Tobin, J., 1958: “Liquidity Preference as Behavior Towards Risk” *Review of Economic Studies* 25, no. 67: 124–131.

Tobin, J., 1967: “A General Equilibrium Approach To Monetary Theory”, *Journal of Money, Credit and Banking*, Vol.1, No1, Feb, pp15-29

Tobias. A., and Shin H. S., 2010: “The changing Nature of Financial Intermediation and the Financial Crisis of 2007-2009”, *Federal Reserve Bank of New York Staff Reports*, no. 439
(March)

Torbecke, E., 1991: “Adjustment, Growth and Income Distribution in Indonesia”, *World Development*, Vol. 19, No.11, pp.1595-1614

“Financial Social Accounting Matrix Indonesia 2005”, Statistics Indonesia and Bank Indonesia, 2009

Ministry of Finance and Economy, 2003: “Financial Liberalization and Domestic Savings in Korea”, 9th APEC Financial Ministers’ Process-Improving the Allocation of Domestic Saving for Economic Development, Jan, pp. 121-136

CHAPTER 3

ANALYZING THE COSTS AND BENEFITS OF BANK-LED INFLOWS WITH POLICY OPTIONS: THE USE OF AHP AND ANP

3.1. Introduction

With the growing frequency and risk of financial crisis, macroprudential policy has become the cornerstone of macro policy. The boom-and-bust cycle analyzed in Chapter 2 is an example of a phenomenon that results from financial crises. Two major components of macro-prudential policies are surveillance (for crisis prevention) and crisis management – both of which may be conducted using bottom-up or top-down approaches. The bank stress test, which is the central aspect of macro-prudential surveillance, is applied by an international organization like the IMF through its Article IV, as well as by national authorities. This test aims to assess system-wide resilience to shocks over the medium term, uncovering vulnerabilities to any rapid deterioration in the macroeconomic environment and identifying potential threats to overall financial stability.

While financial-prudential policy aims to examine the soundness of individual financial institutions (i.e., whether or not they require recapitalization or restructuring), macro-prudential policy aims primarily to restore and sustain market confidence in the financial system. With a broader goal than that of financial-prudential policy, the standard capital adequacy ratio (CAR) is usually raised by adding a countercyclical capital buffer to absorb losses arising from the business cycles and a capital surcharge for “systemically important financial institutions”

(SIFI).

The types of problems that macro-prudential policy addresses can be classified into solvency problems and liquidity problems. The type of issues that become the focus of such policy depends on the prevailing trend that threatens financial stability, e.g., credit boom, house price increase, property bubble, surging consumers' debt.

The link between monetary policy (interest rate) and the balance sheets of agents is central to macroprudential policy, highlighting the importance of monetary authorities focusing not only on price stability but also on financial stability. Many countries in recent years have tried to link the goals of maintaining price stability and securing financial stability. Some countries have amended the central bank's law, which typically only emphasizes the importance of price stability, by explicitly adding financial stability as another goal.²²

To reflect such a reality, when an economy suffers from a boom-and-bust cycle as discussed in Chapter 2, one should expect a macro-prudential policy to be adopted; therefore, this chapter's analyses focus on the choices of macro-prudential policy that are most appropriate in such circumstances. We use the information acquired from the FCGE simulations under the bank-led flows in the previous chapter as a guide in selecting the policy. In those simulations, where banks invest in risky financial assets, it is shown that such a scenario brings some risks as well as potential benefits. In particular, we conduct a Benefits (B), Opportunity (O), Costs (C), and Risks (R) analysis of three alternative policies, upon which basis we propose a policy to

²² Korea is one such example – in 2011, the Bank of Korea (central bank) amended its law by explicitly specifying the importance of achieving financial stability in addition to price stability.

maximize the benefits and opportunities and minimize the costs and risks. The quantitative measures of BOCR are derived according to a model structure the strategic goal of which is to achieve a balanced development that takes social issues into account along with macroeconomic and financial issues.

3.2. Methodology

In selecting policies, the decision-making often centers around the thorough consideration of goals or objectives, criteria and alternatives. A good decision-making model must quantify the perspective and priority of every element in the structure. In this study, we use the analytical hierarchy process (AHP) and analytical network process (ANP) to quantitatively measure the priority ranking of those elements by making pairwise comparisons of the elements in each level (i.e., the goals, criteria and alternatives) with respect to the elements in the level above it.

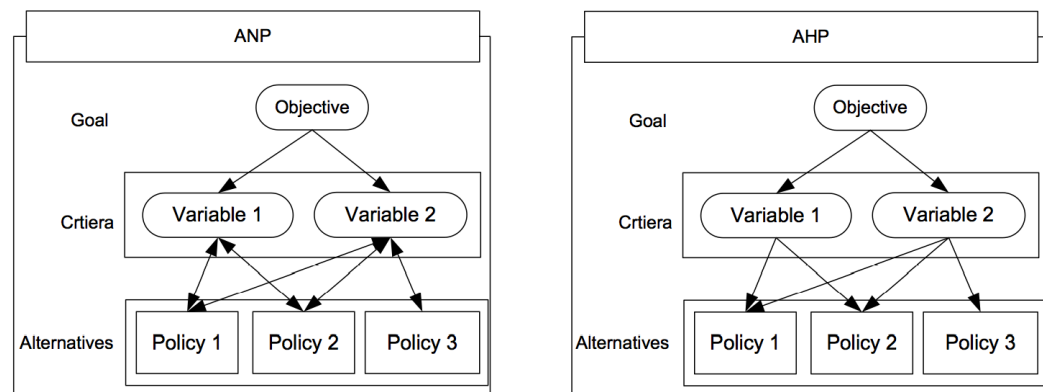


Figure 3.1. Basic Structure of ANP and AHP Models

As shown in Figure 3.1, the starting point of applying AHP and ANP is to construct the relevant hierarchy (for AHP) and network (for ANP).²³ The goal is to describe the decision-making problem at hand. The multi-criteria in the level below the goal consist of choices relevant to the goal (i.e., there can be multiple levels of criteria and sub-criteria in the model). The alternatives, at the bottom level of the hierarchy, are the ultimate components of which we are seeking the priority rankings. The lines/arrows between the levels show the direction of pairwise comparisons. The AHP structure in Figure 1 shows the relationships among elements in criteria and between criteria by which each element in the upper level (Criteria) is connected to elements in the level below it (Alternatives).

Unlike in AHP, the problem in ANP is structured as a hierarchy with feedback effects; it therefore forms a network rather than a hierarchy. ANP is a mathematical theory that allows one to deal systematically with *dependence* and *feedback*. It is a counterpart of influence diagrams in statistical decision analysis that are based on Bayes theorem. Unlike influence diagrams, however, ANP captures influences of feedback and interactions among all elements. Note in Figure 1 that the arrows rising from alternatives to criteria have been added compared to the one-way arrow from criteria to alternatives in AHP. This is the case of *outer dependence*. Results from the ANP are expected to be more accurate and robust than those of AHP (Saaty, 2005).

In our analysis, the goal is to find the most preferred policy that will achieve a

²³ AHP and ANP, developed by Thomas Saaty, represent the general theory of measurement intended to capture people's experience and judgment by using ratio scales from both discrete and continuous paired comparisons in multilevel hierarchic/network structures. Measuring the degree of their relative importance, the quantification of criteria or elements, thus, yields the results that the people's perception and judgment are involved. A general form of AHP structure is shown in Figure 1.

balanced development by ensuring social and macro-financial stability. Given the impacts of bank-led flows on different economic and social variables revealed in Chapter 2, we propose three alternative policies: aggressive monetary policy, assigning levies on bank-led flows, and encouraging capital outflows. These policies will be weighted by taking into account the priority rankings of strategic goals, criteria, and sub-criteria.

3.2.1. The Analytical Hierarchy Process

This section illustrates how the policies are weighted by the priority rankings of strategic goals, criteria, and sub-criteria. The Figure 3.2 shows a model structure of the “chances” component under the “Benefits” in the AHP model. As one of the benefits of the increased bank-led inflows, the increased business and investment opportunities for the economic agents (“chances”) are represented by four elements: investment (ID), consumption (CD), financial income (FIN INC), and imported intermediate goods (FINTM). The four variables are listed by row and column in Table 3.1. The numbers in the off-diagonal are the weights based on the results of the FCGE simulations in Chapter 2. The diagonal elements are all one because there should be no preference of one element over itself. The cell value where CD (row) and FIN INC (column) intersect is 22; this indicates that, compared to the impact of bank-led flows in generating FIN INC, the impact of increased bank-led flows on stimulating CD is far more significant. Given the pairwise nature of the comparisons, the cell value where CD (column) and FIN INC (row) intersect is therefore its reciprocal, i.e., $1/22$. The other elements are derived similarly.

Table 3.1. Relative Intensity of Impact of CFLOW²⁴

| | CD | FIN INC | FINTM | ID |
|---------|--------|---------|---------|---------|
| CD | 1 | 22 | "1/18" | "1/26" |
| FIN INC | "1/22" | 1 | "1/398" | "1/579" |
| FINTM | 18 | 398 | 1 | "1/1.5" |
| ID | 26 | 579 | 1.5 | 1 |

To acquire consistent weights for the four variables, each priority value is divided by the sum of the column. In this case, the sums are 45.05, 1000, 2.56, and 1.71 for the first, second, third, and fourth column, respectively (see Table 3.2).

Table 3.2. The Normalized Results

| Chances | CD | | | FIN INC | | FINTM | | ID | |
|---------|-------|--------------|-------|---------|------|-------|------|------|------|
| CD | 1.00 | 1/45.05 = | 0.022 | 22.00 | 0.02 | 0.06 | 0.02 | 0.04 | 0.02 |
| FIN INC | 0.05 | 0.05/45.05 = | 0.001 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FINTM | 18.00 | 18/45.05 = | 0.400 | 398.00 | 0.40 | 1.00 | 0.39 | 0.67 | 0.39 |
| ID | 26.00 | 26/45.05 = | 0.577 | 579.00 | 0.58 | 1.50 | 0.59 | 1.00 | 0.59 |
| Total | 45.05 | | | 1000.00 | | 2.56 | | 1.71 | |

Table 3.3. Relative Impact of The Four Variables With Respect To Chances

| Chances | CD | FIN INC | FINTM | ID | Weights |
|---------|-------|---------|-------|-------|---------|
| CD | 0.22 | 0.022 | 0.022 | 0.023 | 0.023 |
| FIN INC | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| FINTM | 0.4 | 0.398 | 0.391 | 0.391 | 0.391 |
| ID | 0.58 | 0.579 | 0.586 | 0.586 | 0.586 |

²⁴ The relative intensity among the four variables is entered in the direct data input area in the model as shown in Figure 3.8 in Appendix II. The model then interprets and changes the values to be suitable for the alternative data input formats such as the matrix (Figure 3.9 in Appendix II), graphical and verbal formats. Table 3.1 shows the relative intensity of the impact of CFLOW among the four variables that the model expressed in the matrix format.

To derive the weights in Table 3.3, pick any column, and divide an entry by the total of the column. Table 3.4 is acquired from the comparisons among alternatives with respect to the level of each variable such as CD and FIN INC (see Figure 3.8 in Appendix II for the CD case)

Table 3.4. Relative Importance of The Alternatives With Respect To Each Variable

| CD | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Weights |
|------------------------|-----------------------|--------------------|------------------------|---------|
| 1 Aggressive Monetary | 0.05 | 0.05 | 0.05 | 0.05 |
| 2 Assigning Levies | 0.80 | 0.80 | 0.80 | 0.80 |
| 3 Encouraging Outflows | 0.15 | 0.15 | 0.15 | 0.15 |
| FIN INC | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Weights |
| 1 Aggressive Monetary | 0.60 | 0.60 | 0.60 | 0.60 |
| 2 Assign Levy | 0.35 | 0.35 | 0.35 | 0.35 |
| 3 Encourage Outflows | 0.05 | 0.05 | 0.05 | 0.05 |
| FINTM | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Weights |
| 1 Aggressive Monetary | 0.60 | 0.60 | 0.60 | 0.60 |
| 2 Assigning Levies | 0.10 | 0.10 | 0.10 | 0.10 |
| 3 Encouraging Outflows | 0.30 | 0.30 | 0.30 | 0.30 |
| ID | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encourage Outflows | Weights |
| 1 Aggressive Monetary | 0.05 | 0.05 | 0.05 | 0.05 |
| 2 Assigning Levies | 0.80 | 0.80 | 0.80 | 0.80 |
| 3 Encourage Outflows | 0.15 | 0.15 | 0.15 | 0.15 |

Table 3.5. Jointly Displaying The Relative Importance of All Elements

| | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows |
|-----------------|-----------------------|--------------------|------------------------|
| CD (0.023) | 0.05 | 0.80 | 0.15 |
| FIN INC (0.001) | 0.60 | 0.35 | 0.05 |
| FINTM (0.391) | 0.60 | 0.10 | 0.30 |
| ID (0.586) | 0.05 | 0.80 | 0.15 |

Multiplying each row in Table 3.5 by each weight of the four variables (Table 3.3) yields the following results in Table 3.6.

Table 3.6. Joint Priorities of All Elements and Final Priorities of Alternatives

| | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows |
|--------------|-----------------------|--------------------|------------------------|
| CD | 0.00115 | 0.0184 | 0.00345 |
| FIN INC | 0.0006 | 0.00035 | 0.00005 |
| FINTM | 0.2346 | 0.0391 | 0.1173 |
| ID | 0.0293 | 0.4688 | 0.0879 |
| TOTAL | 0.26565 | 0.52665 | 0.2087 |

The normalized weights or priorities shown in Table 3.1 to Table 3.6 are, however, only approximations for demonstrative purposes. Given any pair-wise matrix in Table 3.1, a more precise ranking can be obtained by normalizing the eigenvector of each matrix (see Saaty, 2005). The eigenvector is based on the maximum eigenvalue of the matrix. The derivation of the eigenvector and eigenvalue is as follows:

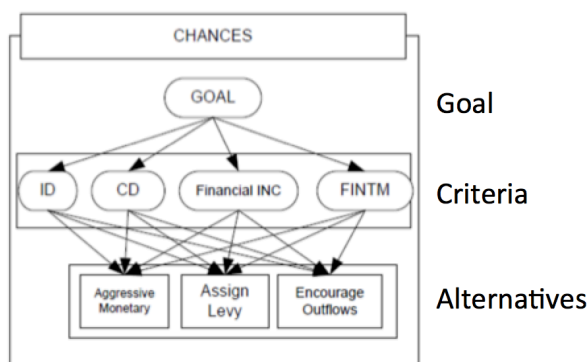


Figure 3.2. AHP Model Structure of “Chances”

Let A_1 , A_2 , A_3 , and A_4 be investment (ID), consumption (CD), financial income (FIN INC), and foreign intermediate goods (FINTM), respectively, in the “criteria” level under “chances” of the benefits (see Figure 3.2). The quantified impact

from the FCGE model on pairs of elements (A_1, A_2, A_3 , and A_4) are represented by 4x4 matrix $A = (a_{ij})$, where $i, j = 1$ to 4. A set of numerical weights w_1, w_2, \dots, w_4 , represents the quantified impact of bank-led inflows on each. In assigning the weights, we use the results from the FCGE simulations in Chapter 2. In matrix form, the absolute scales are as follows:

$$A = \begin{matrix} & \begin{matrix} A_1 & A_2 & A_3 & A_4 \end{matrix} \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{vmatrix} w_1/w_1 & w_1/w_2 & w_1/w_3 & w_1/w_4 \\ . & . & . & . \\ w_4/w_1 & w_4/w_2 & w_4/w_3 & w_4/w_4 \end{vmatrix} \end{matrix}$$

Consider the “Criteria” level in the hierarchy in Figure 3.2. The four elements A_1, A_2, A_3 , and A_4 are compared in a pairwise manner. By multiplying A with the vector of weights w , we obtain a homogeneous system of linear equations (1),

$$A w = \begin{matrix} & \begin{matrix} A_1 & A_2 & A_3 & A_4 \end{matrix} \\ \begin{matrix} A_1 \\ A_2 \\ A_3 \\ A_4 \end{matrix} & \begin{vmatrix} w_1/w_1 & w_1/w_2 & w_1/w_3 & w_1/w_4 \\ . & . & . & . \\ w_4/w_1 & w_4/w_2 & w_4/w_3 & w_4/w_4 \end{vmatrix} \end{matrix} \times \begin{vmatrix} w_1 \\ w_2 \\ w_3 \\ w_4 \end{vmatrix} = \begin{vmatrix} w_1 \\ w_2 \\ w_3 \\ w_4 \end{vmatrix} = n w$$

$$A w = n w \quad (1)$$

Solving the homogenous system of linear equations to find w is a trivial eigenvalue problem. Since every row is a constant multiple of the first row, \mathbf{A} has unit rank. To recover the scale from the matrix ratios, the following system should be solved:

$$(\mathbf{A} - \mathbf{nI})\mathbf{w} = \mathbf{0}$$

A nontrivial solution can be obtained if and only if $\det(\mathbf{A} - \mathbf{nI}) = 0$, i.e., the characteristic equation of \mathbf{A} . Hence, \mathbf{n} is an eigenvalue and \mathbf{w} is an eigenvector of \mathbf{A} . Given \mathbf{A} having unit rank, all its eigenvalues except for one are zero, and the only nonzero eigenvalue is therefore a maximum. Thus, the trace of \mathbf{A} is equal to \mathbf{n} .

One of the most important factors in the pairwise comparison is consistency, which is associated with the assumption of *transitivity*: if $A > B$ and $B > C$, then $A > C$. In the model, the transitivity required for the consistency of impacts is represented as a consistency index, $a_{ij} \cdot a_{jk} = a_{ik}$ for all i, j, k . If each entry in \mathbf{A} is denoted by a_{ij} , then $a_{ij} = 1/a_{ji}$, the reciprocal property, holds, and so does $a_{jk} = a_{ik} / a_{ij}$, which is consistency property, where $a_{ii} = a_{ij} = 1$. Therefore, if we are to rank \mathbf{n} number of elements, i.e., \mathbf{A} is the size \mathbf{n} -by- \mathbf{n} , then the required number of inputs (from the paired comparison) is less than \mathbf{n}^2 ; it is equal to only the number of entries of the sub-diagonal part of \mathbf{A} . Hence, when there are four elements in the hierarchy, only six input judgments are required.

In the general case, though, the precise value of w_i / w_j is hardly given, because the

input judgment is only an estimate. This suggests that there are some perturbations when the judgment does not perfectly satisfy the consistency, resulting in (2) while the reciprocal property still holds. By taking the largest eigenvalue of $A' = (a_{ij})'$, denoted by λ_{\max} ,

$$A' w' = \lambda_{\max} \cdot w' \quad (2)$$

where A' is the actual, or the given, matrix which is perturbed from matrix A .

The solution is obtained by the following procedure of calculations: (i) raise the matrix to a sufficiently larger power (Power Method), (ii) sum over rows and normalize it to obtain the priority vector $w' = (w_1', \dots, w_n')^T$, and (iii) stop when the difference between the priority vector at the k^{th} power and the priority vector at $k-1^{\text{th}}$ power is sufficiently insignificant.

Despite the difference between (1) and (2), if w' is obtained by solving (2), the matrix whose entries are w_i/w_j is still a consistent matrix; it is a consistent estimate of A , even though A itself does not need to be consistent. A' will be consistent if and only if $\lambda_{\max} = n$. As long as the precise value of w_i/w_j cannot be given, due to bias in the judgment, λ_{\max} is always greater than or equal to n . Hence, a measure of consistency can be derived based on such deviation of λ_{\max} from n .

A consistency index (CI) is acquired by $(\lambda_{\max} - n)/(n - 1)$. Comparing CI with random index (RI), which is the same index calculated from a randomly generated reciprocal matrix using the scale 1/9, 1/8, ..., 1, ..., 8, 9, one can generate a consistency ratio (CR), which is the ratio of CI to average RI. This ratio can also be considered as the overall inconsistency index; however, in solving for w , the *transitivity* is not a

strict assumption in the model, reflecting an inconsistent tendency of human preference and judgment. The model allows the threshold point, $CR = 0.10$, that is shown whenever the ranking of the elements at the bottom level of each hierarchy is computed.

3.2.2. The Analytical Network Process

Both AHP and ANP use the abovementioned procedure to derive the ratio scales. ANP requires a large matrix called the *supermatrix* that contains a set of submatrices. This supermatrix captures the influence of elements on other elements in the network. Denoting a cluster by C_h , $h = 1, \dots, N$, and assuming that it has n_h elements $e_{h1}, e_{h2}, e_{h3}, \dots, e_{h n_h}$, Figure 3.3 shows the supermatrix of the network, i.e., ANP model in..... With all elements and clusters that affect each other, the feedback influences are presented as in the supermatrix in Figure 3.3 (left) that is formed by assigning W values for all the clusters and all the elements in each cluster both vertically on the left and horizontally.

$$W = \begin{matrix} & \begin{matrix} C_1 & C_2 & \dots & C_N \end{matrix} \\ \begin{matrix} C_1 \\ C_2 \\ \vdots \\ C_N \end{matrix} & \begin{bmatrix} \begin{matrix} e_{11} & e_{12} & \dots & e_{1n_1} \end{matrix} & \begin{matrix} e_{21} & e_{22} & \dots & e_{2n_2} \end{matrix} & \dots & \begin{matrix} e_{N1} & e_{N2} & \dots & e_{Nn_N} \end{matrix} \\ \begin{matrix} W_{11} & W_{12} & \dots & W_{1N} \\ W_{21} & W_{22} & \dots & W_{2N} \\ \vdots & \vdots & \ddots & \vdots \\ W_{N1} & W_{N2} & \dots & W_{NN} \end{matrix} \end{bmatrix} \end{matrix}$$

$$W_{ij} = \begin{bmatrix} W_{i1}^{(j_1)} & W_{i1}^{(j_2)} & \dots & W_{i1}^{(j_{n_j})} \\ W_{i2}^{(j_1)} & W_{i2}^{(j_2)} & \dots & W_{i2}^{(j_{n_j})} \\ \vdots & \vdots & \ddots & \vdots \\ W_{in_i}^{(j_1)} & W_{in_i}^{(j_2)} & \dots & W_{in_i}^{(j_{n_j})} \end{bmatrix}$$

Figure 3.3. Supermatrix of ANP(left) and Entry in the Supermatrix (right)²⁵

²⁵ Saaty, 2006

where i and j denote the influenced and influencing cluster, respectively, and n is the element of the respected cluster. A typical entry in the supermatrix (*unweighted*) is shown in Figure 3.3 (right). The entries of sub-matrices in W_{ij} are the ratio scales derived from paired comparisons from outer dependence or inner dependence. To obtain priorities from the supermatrix, the resulting *unweighted supermatrix* is then transformed into a matrix where each of the columns sums to unity to generate a stochastic supermatrix, i.e., a *weighted supermatrix*. If the matrix is stochastic, the limit priorities can be viewed in such a way so as to depend on the concepts of reducibility, primitivity, and cyclicity of the matrix (Saaty, 2001). Then, the weighted matrix needs to be powered to capture indirect influences as well as the direct influences that the weighted supermatrix renders. For example, squaring the weighted matrix captures the indirect influence. An element influences the second element directly and indirectly through its influence on some third element; the second element can be influenced also by every such possibility of influence of a third element. The influences by which the third element also affects the fourth, which in turn influences the second can be obtained from the cubic power of the weighted supermatrix. As the process is performed continuously, one will have an infinite sequence of influence matrices denoted by W^k , $k = 1, 2, \dots, n$. If one takes the limit of the average of a sequence of N of these powers of the supermatrix, the resultant *limiting super matrix* must converge, thereby showing the existence of a limit.²⁶ Thus, the

²⁶ Saaty (2001) shows the existence of a limit given the stochastic nature of the weighted supermatrix.

powers of the *supermatrix* do not converge unless it is stochastic. In practice, by raising the stochastic *supermatrix* to large powers, we produce the final priorities in which all columns of the matrix are identical and each gives the relative priorities of the elements. Note that the priorities of the elements in each cluster are normalized to one.

The priorities in the ANP model are acquired from the model by the three sequential orders (see Table 3.7 for an example): (1) the original *unweighted supermatrix* of column eigenvectors obtained from pairwise comparison matrices of elements; (2) the weighted supermatrix in which each block of column eigenvectors belonging to a cluster is weighted by the priority of influence of that cluster, rendering the *weighted supermatrix* column stochastic; and (3) the limiting supermatrix obtained by raising the weighted supermatrix to large powers (Azis, 2003).

When a convergence is not achieved, the average of the successive matrices of the entire cycle gives the final priorities in which the limit cycles in blocks and the different limits are summed and averaged and again normalized to one for each cluster.

Table 3.7. Supermatrices for “Chances” under Benefits from ANP model:

Unweighted, Weighted, and Limit Matrices

| Unweighted | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Chances | CD | FIN INC | FINTM | ID |
|------------------------|-----------------------------|--------------------------|------------------------------|---------|------|---------|-------|------|
| 1 Aggressive Monetary | 0 | 0 | 0 | 0 | 0.05 | 0.6 | 0.6 | 0.05 |
| 2 Assigning Levies | 0 | 0 | 0 | 0 | 0.8 | 0.35 | 0.1 | 0.8 |
| 3 Encouraging Outflows | 0 | 0 | 0 | 0 | 0.15 | 0.05 | 0.3 | 0.15 |
| Chances | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CD | 0.13 | 0.13 | 0.25 | 0.022 | 0 | 0 | 0 | 0 |
| FIN INC | 0.35 | 0.35 | 0.13 | 0.001 | 0 | 0 | 0 | 0 |
| FINTM | 0.25 | 0.25 | 0.35 | 0.39799 | 0 | 0 | 0 | 0 |
| ID | 0.27 | 0.27 | 0.27 | 0.57901 | 0 | 0 | 0 | 0 |

| Weighted | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Chances | CD | FIN INC | FINTM | ID |
|------------------------|-----------------------------|--------------------------|------------------------------|---------|------|---------|-------|------|
| 1 Aggressive Monetary | 0 | 0 | 0 | 0 | 0.05 | 0.6 | 0.6 | 0.05 |
| 2 Assigning Levies | 0 | 0 | 0 | 0 | 0.8 | 0.35 | 0.1 | 0.8 |
| 3 Encouraging Outflows | 0 | 0 | 0 | 0 | 0.15 | 0.05 | 0.3 | 0.15 |
| Chances | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CD | 0.13 | 0.13 | 0.25 | 0.022 | 0 | 0 | 0 | 0 |
| FIN INC | 0.35 | 0.35 | 0.13 | 0.001 | 0 | 0 | 0 | 0 |
| FINTM | 0.25 | 0.25 | 0.35 | 0.39799 | 0 | 0 | 0 | 0 |
| ID | 0.27 | 0.27 | 0.27 | 0.57901 | 0 | 0 | 0 | 0 |

| Limit | 1 Aggressive Monetary | 2 Assigning Levies | 3 Encouraging Outflows | Chances | CD | FIN INC | FINTM | ID |
|------------------------|-----------------------------|--------------------------|------------------------------|---------|---------|---------|---------|---------|
| 1 Aggressive Monetary | 0.18477 | 0.18477 | 0.18477 | 0.18477 | 0.18477 | 0.18477 | 0.18477 | 0.18477 |
| 2 Assigning Levies | 0.23605 | 0.23605 | 0.23605 | 0.23605 | 0.23605 | 0.23605 | 0.23605 | 0.23605 |
| 3 Encouraging Outflows | 0.07918 | 0.07918 | 0.07918 | 0.07918 | 0.07918 | 0.07918 | 0.07918 | 0.07918 |
| Chances | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| CD | 0.0745 | 0.0745 | 0.0745 | 0.0745 | 0.0745 | 0.0745 | 0.0745 | 0.0745 |
| FIN INC | 0.15758 | 0.15758 | 0.15758 | 0.15758 | 0.15758 | 0.15758 | 0.15758 | 0.15758 |
| FINTM | 0.13292 | 0.13292 | 0.13292 | 0.13292 | 0.13292 | 0.13292 | 0.13292 | 0.13292 |
| ID | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 | 0.135 |

3.2.3. BOCR under Bank-led Inflows

The AHP and ANP models provide pairwise comparison of impacts; deriving priorities from these different impacts, synthesizing the priorities to determine the best alternative –in this case, the policy – in order to achieve the balanced development. Each of the variables is evaluated to determine which of the variables are more influenced by the capital inflows and by how much. The intensities are determined according to the outcome of the FCGE simulations under bank-led inflows in the previous chapter. Finally, each policy will be evaluated given socio-economic variables with respect to the goal, yielding the most important policy that generates benefits and opportunities and reduces costs and risks to achieve balanced development.

Figure 3.4 and Figure 3.5 show the AHP and ANP model respectively used in this chapter to determine which policy is most likely to achieve the balanced development given the impacts of bank-led inflows on the variables. The specific numbers representing the impacts are acquired from the FCGE model. Achieving balanced development is the goal, and benefits (B), opportunities (O), costs (C), and risks (R) are set to evaluate each criterion: the BOCRs of having bank-led inflows in the emerging economies.

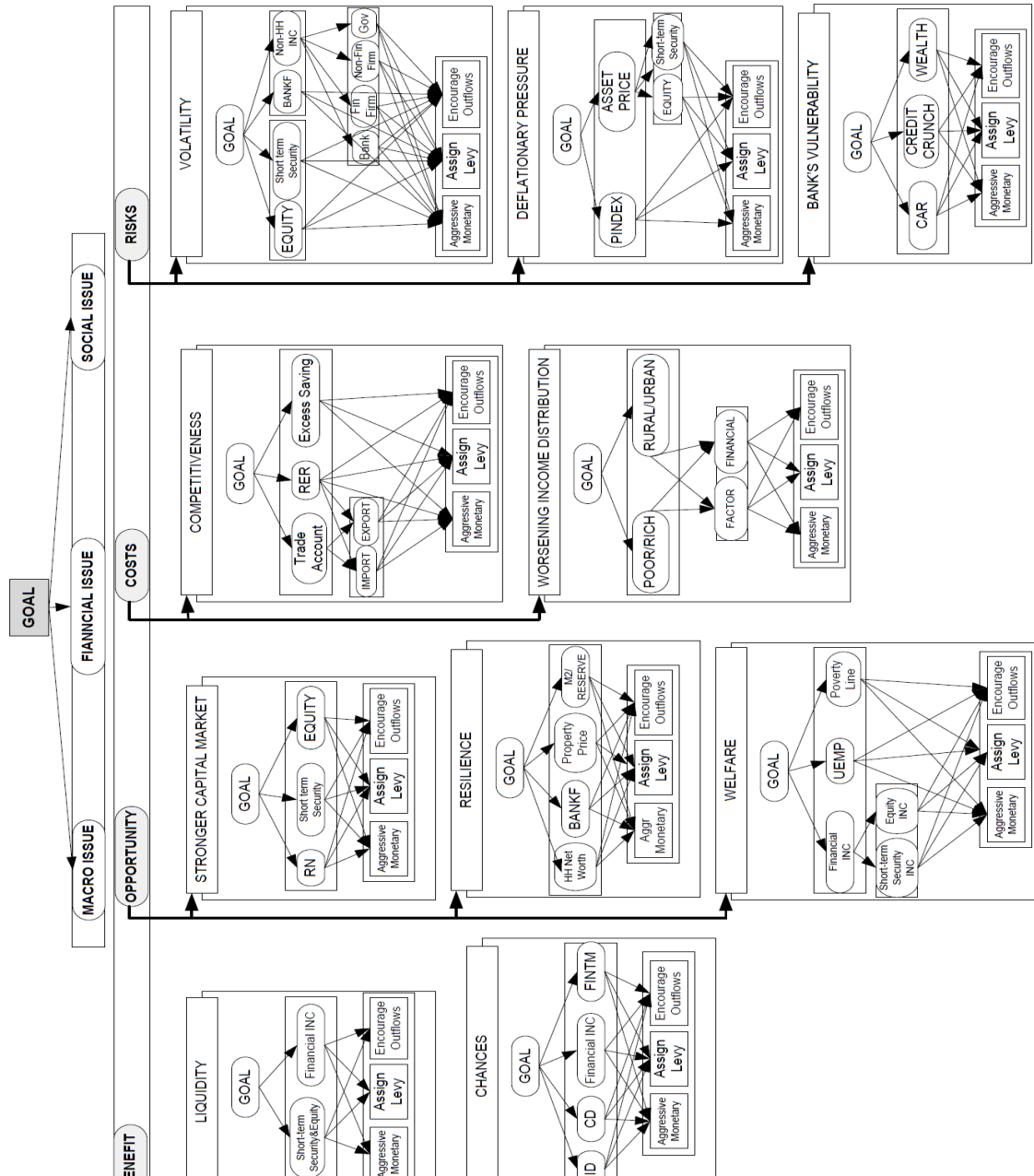


Figure 3.4. The Whole Structure of AHP Model

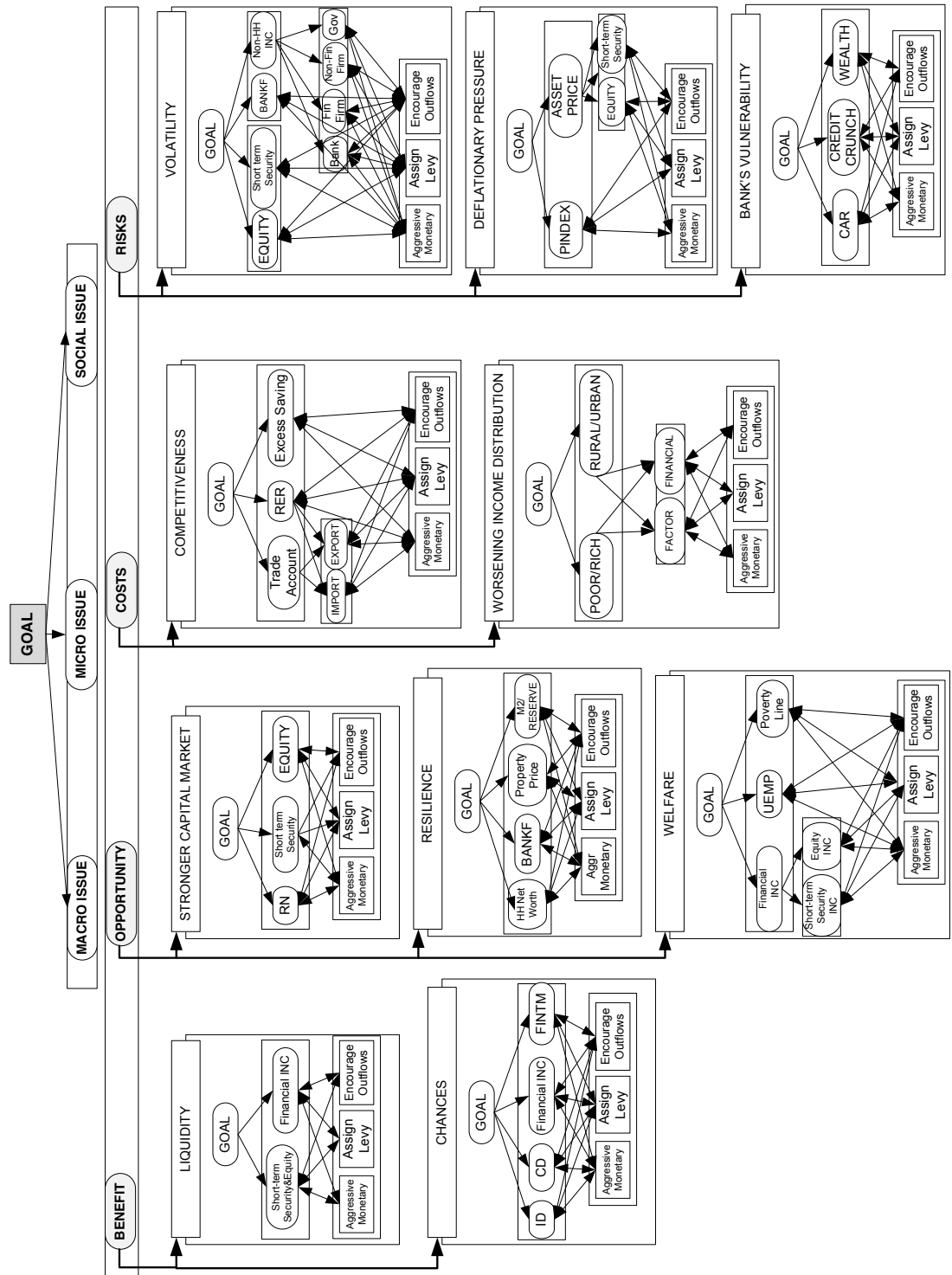


Figure 3.5. The Whole Structure of ANP Model

3.2.3.1. Benefits and Opportunities

In the short term, the bank-led inflows are beneficial to the recipient economies because they allow the economic agents to have more liquidity (Liquidity). One way to measure the increase in liquidity is by examining the changes in the volume of financial assets such as short-term security and equity assets (Short-term security & equity) available in the FCGE model. Also, the increase in the financial income of the agents (FIN INC) due to the bank-led inflows can provide a good measure of the increased liquidity. Bank-led inflows can also be beneficial in the short term because they provide more investment options (Chances) by which various financing sources and financial instruments are made available. Having more options for financing can boost investment (ID) and consumption (CD). Increased ID and CD are associated with increased demands for more products and more intermediate inputs, particularly imported ones (FINTM). The capital inflows can also be favorable to the financial income (FIN INC) as more people can become more involved in financial investment, providing more income.

Furthermore, in the long run, the bank-led inflows can be beneficial because they can strengthen the capital market (Stronger Capital Market) given the financial market development. The return on financial assets (RN) will be increased as well as the boom in short-term securities (Short-term security) and equity market (Equity). Also, the bank-led inflows can be opportunities for ensuring resilience (Resilience). Under the development of the financial sector, households have more access to the market and their net worth (HH Net Worth) can be benefited. In this situation, the banking sector would have more capital for credit (BANKF). The economy would also

gain opportunities from the increased property prices. In the long run, the capital inflows can increase the ratio of M2 to reserve. Finally, the bank-led inflows can improve the welfare (Welfare) of the society. With an increase in the financial income of households (FIN INC), more jobs (UEMP) can be created, which in turn helps the poor (Poverty line).

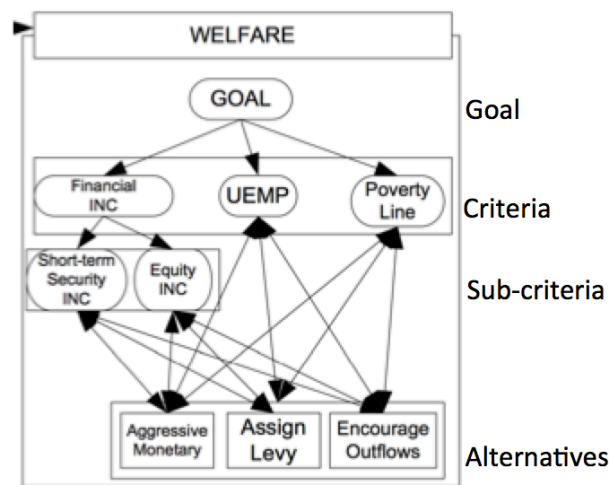


Figure 3.6. ANP Model Structure of "Welfare" under Opportunities²⁷

Under each category of Benefits and Opportunities, the socio-economic variables are placed in a hierarchy and in a network, consisting of the variables and impact data acquired from the FCGE model simulations. Figure 3.6 depicts the structure of one of the opportunities – namely, welfare – consisting of goals, criteria, sub-criteria, and alternatives. The networks are ranked by the following questions: (1) [between goal and criteria] Which of the welfare variables would be more influenced positively by the increased debt flow through the banking sector given the goal to

achieve balanced development, the financial income from short-term security and equity or unemployment rate, or poverty?; (2) [between criteria and sub-criteria] which is more affected by the capital flows, short-term security income or equity income; and (3) [between criteria and alternatives] For capital flows to be beneficial to the economy in the long run with respect to increasing financial income, decreasing unemployment, or decreasing poverty, which policy would be more preferred?; and (4) [between alternatives and criteria (sub-criteria)] which of the variables would be more positively affected by the policy? The latter is a feedback question found only in the ANP model.

3.2.3.2. Costs and Risks

The inflows, however, can create costs and risks in the economy as well. The bank-led inflows can cause a loss of competitiveness (Competitiveness) of the export products in the global market by making the price of domestic currency expensive (RER), yielding a trade account deficit (Trade Account). Excess saving? Also foreign capital inflows through the banking sector can worsen the income distribution (Worsening income distribution) because the beneficiaries of financial market development are mostly the rich.²⁸ It is expected that income distributions between poor and rich (Poor/Rich), and between rural and urban areas (Urban/Rich), will be exacerbated. Furthermore, the inflows can carry risks, especially in the long run: this can provide some incentives to the banking sector to become involved in risky

²⁷ See Appendix III for this example in the ANP model using Super Decision software.

²⁸ In the previous chapter, it was shown that CFLOW worsens the income distribution especially when the banking sector involves risky investments.

investments, which makes the banks vulnerable (Bank's vulnerability). Risky investment decreases banks' ratio of capital to risky assets (CAR). According to credit channel theory, as explained in the previous chapter, the banking sector will be reluctant to extend credit in such a highly uncertain environment, thereby decreasing the availability of loans in the economy, and possibly leading to a credit crunch (Credit Crunch). Due to the nature of bank-led capital inflows, i.e., volatility, banks' wealth can be vulnerable depending on the fluctuations of the financial market, especially when the banking sector is actively involved in risky investments. The bank-led inflows can also create a risk of deflationary (Deflationary Pressure) pressure. Price (PINDEX) and asset prices (Asset Price) are decreased, negatively affecting the income of the economic agents. The flows create volatility (Volatility) in the overall economy, depending on the fluctuations of capital flows. Massive outflows due to the external shock (e.g., GFC and Euro zone crisis) bring high volatility – volatility in financial assets and non-household incomes. Banks' available funds will decline as capital leaves that was previously intermediated through the banking sector.

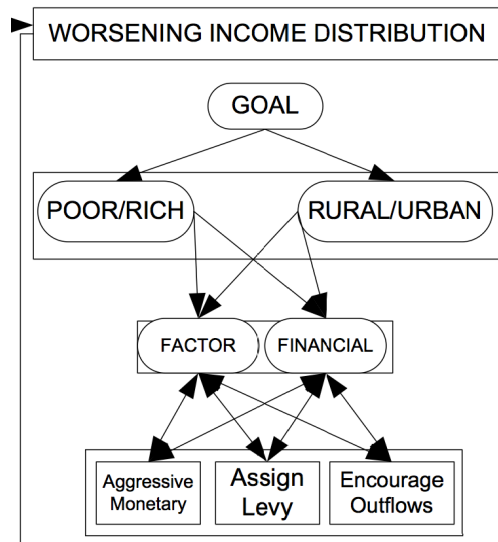


Figure 3.7. ANP Model Structure of “Worsening Income Distribution” under Costs

Figure 3.7 depicts the structure of one of the costs – namely, worsening income distribution– consisting of goals, criteria, sub-criteria, and alternatives. The networks are ranked by the following questions. (1) [Between goal and criteria] with the increased debt flow through the banking sector, and given the goal to achieve balanced development, the cost in terms of worsening income distribution is measured by income distribution between poor and rich, and rural and urban areas. Which is more negatively affected by capital inflows? (2) [Between criteria and sub-criteria] which is more affected by capital flows, factor income or financial income? (3) [Between criteria (sub-criteria) and alternatives] where will the negative impact of capital flows be directed, and how much is the impact measured from the FCGE simulation under bank-led capital inflows? Also, given the bank-led capital flows to achieve the balanced development, which policy will be more costly with respect to worsening factor income distribution and financial income distribution? (4) [Between alternatives

and criteria (sub-criteria)] which variables will be more negatively affected by the policy? This last question is a feedback question only found in the ANP model.

3.2.3.3. The Alternatives

For the model summarized in Figure 3.4 and Figure 3.5, the three policy measures being proposed are all parts of the macro-prudential policy aiming at maintaining financial stability amidst increased bank-led flows.

Aggressive Monetary Policy: Given the presence of the credit channel and the amplified effect of the flows described in Chapter 2, the policy response needs to be more forceful, i.e., greater in magnitude and intensity. When credit growth is excessive, for example, interest rates must be raised higher than under a standard assumption of an overheating economy without considering credit channels and amplification of the effects. On the other hand, when downward pressure on economic growth is strong, or deflationary pressure is imminent, interest rates ought to be reduced much more than under a standard assumption (e.g., what the US Fed, Bank of Japan, and the ECB have been doing during the current global financial crisis).

Assigning Levies: To the extent that bank-led inflows can create vulnerability (see Chapter 2), capital controls have been implemented in many flow-receiving countries; however, across-the-board capital control of various sorts can create distortions, the negative effects of which can offset the potential benefits to the economy. It is therefore preferable to impose targeted controls. Since the type of inflows we are dealing with here is bank-led flows that will augment banks' balance sheets through rising non-core liabilities, the controls should focus precisely on

accounts. One of the policies widely proposed in this regard is imposing levies on non-core liabilities. The idea is not to prevent the inflows entirely but to make banks more cautious about both receiving the flows and using the funds. It is expected that, with such a levy, banks would be more cautious and not take excessive risks.

Encouraging Outflows: As with all inflows, the immediate repercussion is on the exchange rate. For many emerging economies that rely on exports, an appreciated exchange rate spells bad news as it can have a negative price-effect on exports. In response, the monetary authority usually intervenes in the foreign exchange market to prevent the currency from appreciating, but the intervention can be inflationary as it raises the amount of the money supply. Under normal circumstances, such a policy is followed by some sterilization measures; however, this may lead to higher interest rates that attract even more capital inflows. Absence of sterilization policy, on the other hand, implies a loss of monetary control. This well-known “impossible trinity” problem can be mitigated when the supply-demand balance of foreign exchange does not change much, in which case the need for the monetary authority to intervene is also less. To the extent that capital inflows cannot be stopped, this can be made possible only by countering the inflows with outflows. This is why some emerging economies that receive massive amounts of capital inflows have made efforts to encourage capital outflows or investment abroad.

3.3. Analysis

3.3.1. The AHP Model

Table 3.8. Inputs from FCGE Simulations for BOCR

| | | | Percentage Change | Normalized Percentage Change | |
|--------------------------------|--------------------------------------|-----------------------------------|------------------------|------------------------------|-------|
| Benefits | Liquidity (0.65) | Short-term security & equity | 0.219 | 0.801 | |
| | | Financial income | 0.054 | 0.199 | |
| | Chances (0.35) | ID | 29.092 | 0.579 | |
| | | CD | -1.096 | 0.022 | |
| | | Financial income | 0.054 | 0.001 | |
| FINTM | | 20.007 | 0.398 | | |
| Opportunities | Stronger Capital Market (0.5) | RN | 0.045 | 0.087 | |
| | | Short-term security | 0.285 | 0.556 | |
| | | Equity | 0.183 | 0.357 | |
| | Resilience (0.3) | HHH net worth | 0.008 | 0.000 | |
| | | BANKF | 0.016 | 0.001 | |
| | | Property price | -16.776 | 0.994 | |
| | | M2/RESERVE | -0.076 | 0.005 | |
| | Welfare (0.2) | Financial income (Rn*asset) | 0.054 | 0.000 | |
| | | UEMP | -143.311 | 0.895 | |
| PL | | -16.809 | 0.105 | | |
| Short-term security income | | 0.360 | 0.663 | | |
| | | Equity income | 0.183 | 0.337 | |
| Costs | Competitiveness (0.65) | Excess saving | -168.690 | 0.263 | |
| | | RER | -5.454 | 0.009 | |
| | | Trade account | -467.476 | 0.729 | |
| | | EXR (P-Import) | -17.000 | 0.500 | |
| | | EXR (P-Export) | -17.000 | 0.500 | |
| | | Trade Account (import) | 30.651 | 0.800 | |
| | | | Trade Account (export) | 7.640 | 0.200 |
| | Worsening Income Distribution (0.35) | Poor/Rich | -0.391 | 0.807 | |
| | | Rural/Urban | -0.093 | 0.193 | |
| | | Poor/Rich (factor) | -0.183 | 0.976 | |
| Poor/Rich (financial) | | -0.004 | 0.024 | | |
| | | Rural/Urban (factor) | -0.058 | 0.738 | |
| | | Rural/Urban (financial) | -0.021 | 0.262 | |
| Risks | Deflationary Pressure (0.2) | PINDEX | -16.814 | 0.997 | |
| | | Asset Price | 0.045 | 0.003 | |
| | | Asset price (equity) | 0.366 | 0.270 | |
| | | Asset price (short-term security) | 0.989 | 0.730 | |
| | Bank's Vulnerability (0.5) | CAR | -0.020 | 0.009 | |
| | | Credit crunch (bank loan) | 2.121 | 0.989 | |
| | | Wealth | -0.003 | 0.001 | |
| | Volatility (0.3) | Equity | 0.057 | 0.236 | |
| | | Short-term security | 0.135 | 0.565 | |
| | | BankF | -0.010 | 0.042 | |
| | | Non-HHH Income | -0.038 | 0.157 | |
| | | Income (bank's Income) | -0.018 | 0.083 | |
| | | Income (Fin Firm's Income) | -0.001 | 0.006 | |
| Income (non Fin Firm's Income) | | -0.100 | 0.451 | | |
| Income (gov's Income) | -0.103 | 0.461 | | | |

Table 3.9. Overall Ranking for Each BOCR using AHP Model

| AHP | Benefits | Ranking | Opportunities | Ranking | Costs | Ranking | Risks | Ranking |
|----------------------|----------|---------|---------------|---------|-------|---------|-------|---------|
| Aggressive Monetary | 0.375 | 2 | 0.489 | 1 | 0.760 | 1 | 0.653 | 1 |
| Assigning Levies | 0.466 | 1 | 0.380 | 2 | 0.061 | 3 | 0.081 | 3 |
| Encouraging Outflows | 0.159 | 3 | 0.131 | 3 | 0.180 | 2 | 0.266 | 2 |

Looking at the benefits cluster, the two immediate benefits that can be reaped from increased CFLOWS are higher liquidity and opportunities to stimulate investment (ID), consumption (CD), and financial income (FIN INC), and to import intermediate goods (FINTM). Based on the model simulation in Chapter 2, the most likely effects occur in short-term security and equity market (weight = 0.801; see Table 3.8). Given that information, the policy that will most likely realize those benefits is assigning levies on capital flows and an aggressive monetary policy (ranked 0.466 and 0.375, respectively; see Table 3.9). Some of the potential benefits from increased capital flow may be realized in the short run but not in the long run. In the AHP model, this is labeled ‘Opportunities’ (future benefits). Of the three components under Opportunities that increase, CFLOW will have the potential to make the capital market stronger, particularly in the short-term security market (0.556 in Table 3.9). Indeed, in most emerging market economies, one of the key sources for capital market development is improved liquidity. When the CFLOW is intermediated by the banking sector and those flows are invested in the financial market, this will help to improve the liquidity of the capital market.

The second most likely type of future benefit is improved resilience for the

economy. There are two possible scenarios of increased CFLOW: (1) Most of the flows go to domestic assets, including those in the property market, or (2) most of the flows go strictly to the financial market. Due to the weak linkage between housing/property market and the financial market in many emerging market economies, these two scenarios are likely unrelated. Thus, increase CFLOW raises either the price of property or the prices in the financial market. The latter implies that property prices will not only be unaffected but will likely even decline. From the model simulation in Chapter 2, it is revealed that this second scenario applies. The decline in the property price helped to strengthen the macroeconomic stability of the country. Thus, it also improves the resilience of the country's economy. As shown in Table 3.8, lower property price is the most significant component that helps improve the resilience of the economy (0.994). Moving to the cost side, the most immediate adverse impact of the CFLOW is stronger currency, which will damage the country's competitiveness. This is supported by the result from the AHP model, where the competitiveness factor is ranked bigger than other component (worsening income distribution). The future adverse impact, represented by the risk in the AHP model, consists of three components – deflationary pressure, increased vulnerability of the banks, and increased income and financial volatility. Of these three components, banks' vulnerability is the most significant since CFLOWS are intermediated by the banking sector. As discussed in Chapter 2, increased CFLOW may lead to riskier behavior in the banking sector or higher bank credit. In the current scenario, the increased funding in the non-core liabilities of the banking sector is mostly spent on risky financial assets. That alone will raise banks' vulnerability. Even if most of the

increased non-core liabilities are spent on bank loans, there remains a risk of credit crunch when there is deleveraging, similar to what happened during the Eurozone Crisis. Either way, the increased CFLOW will potentially increase banks' vulnerability. Among the three sub-components of banks' vulnerability, a possible credit crunch is most significant. Increased CFLOW may also cause an increase in financial market and income volatility, because such inflows are of the portfolio flows category, which by nature are volatile. The volatility of the flows is usually detected by the sudden reversal from inflows to outflows. The results shown in Table 3.8 are based on the model simulation under the scenario of such sudden reversal. Among the sub-components, volatility in the short-term security market is the most likely to be followed by volatility in equity. Given the above ranking of components and sub-components for BOCR, we rank the relevance of the three policies as follows: 1) aggressive monetary policy, 2) assigning levies on bank-led flows, and 3) encouraging capital outflows. The resulting priority of the policies under the benefits cluster is thus as follows: 1) assigning levies, 2) aggressive monetary, and 3) encouraging outflows as shown in Table 3.9. The following ranking is obtained under the opportunities cluster: 1) aggressive monetary, 2) assigning levies, and 3) encouraging outflows; however, when we do the ranking for the cost and risk cluster, the nature of the question must be reversed, i.e., given a certain component 'which policies are more costly (or risky)'. The results indicate that while the aggressive monetary policy is beneficial in the long run, it is also most costly and most risky, followed by encouraging outflows and assigning levies. Thus, it is interesting to note that some policies that are potentially beneficial can also potentially be damaging, while some

policies that are most beneficial may also be the least damaging to the economy. It is in this context that one must compare the benefits and opportunities with the costs and risks in order to achieve a more balanced perspective. In this study, I use two approaches to develop a measure for such a balanced perspective: $(B*O)/(C*R)$ or *multiplicative* and $bB+oO-cC-r$ or *additive*. The latter method is preferable and suggested by Saaty.

Table 3.10. Overall Ranking using ANP through *Multiplicative* and *Additive* Synthesis

| AHP | Opportunities | | Costs c=0.2 5 | Risks r=0.2 5 | $(B*O)/(C*R)$ | $bB+oO-cC-r$ | Ranking |
|----------------------|---------------|--------|---------------------|---------------------|---------------|--------------|----------|
| | Benefits | | | | | | |
| | b=0.25 | o=0.25 | | | | | |
| Aggressive Monetary | 0.375 | 0.489 | 0.760 | 0.653 | 0.370 | -0.137 | 3 |
| Assigning Levies | 0.466 | 0.380 | 0.061 | 0.081 | 36.332 | 0.176 | 1 |
| Encouraging Outflows | 0.159 | 0.131 | 0.180 | 0.266 | 0.434 | -0.039 | 2 |

The overall results indicate that, in this particular case, either measure will yield the same ranking. Such an outcome, however, cannot be generalized. In some cases, they show different rankings, while in other cases, they even show rank reversal. From Table 3.10, it is clear that after considering BOCR and the importance of each of the policies with respect to each component, which is an additive method, the preferred policy is to assign levy to bank-led flows. At this juncture, it is important to emphasize that such results are based on the overall strategic goals that include not just macroeconomic issues but also financial and social issues. Had the goal been merely to maintain macroeconomic stability, for example, the priority ranking of the

policy would have been different. In most cases, when there is capital flow reversal, aggressive monetary policies are strongly recommended and widely implemented, as with the tightening that occurred during the AFC in 1997. In the current scenario, in contrast, such a policy is ranked the lowest.

Table 3.11. Overall Ranking using AHP through *Multiplicative* and *Additive* Synthesis under Different Weights on BOCR

| AHP | Benefits | Opportunities | Costs | Risks | $(B*O)/(C*R)$ | $bB+oO-cC-rR$ | Ranking |
|----------------------|----------|---------------|--------|-------|---------------|---------------|----------|
| | b=0.25 | o=0.1 | c=0.35 | r=0.3 | | | |
| Aggressive Monetary | 0.375 | 0.489 | 0.760 | 0.653 | 0.370 | -0.319 | 3 |
| Assigning Levies | 0.466 | 0.380 | 0.061 | 0.081 | 36.332 | 0.109 | 1 |
| Encouraging Outflows | 0.159 | 0.131 | 0.180 | 0.266 | 0.434 | -0.090 | 2 |

| AHP | Benefits | Opportunities | Costs | Risks | $(B*O)/(C*R)$ | $bB+oO-cC-rR$ | Ranking |
|----------------------|----------|---------------|--------|-------|---------------|---------------|----------|
| | b=0.35 | o=0.3 | c=0.25 | r=0.1 | | | |
| Aggressive Monetary | 0.375 | 0.489 | 0.760 | 0.653 | 0.370 | 0.0227 | 3 |
| Assigning Levies | 0.466 | 0.380 | 0.061 | 0.081 | 36.332 | 0.2540 | 1 |
| Encouraging Outflows | 0.159 | 0.131 | 0.180 | 0.266 | 0.434 | 0.0233 | 2 |

In some cases, we may wish to assign different weights for BOCR. As shown in the first table in Table 3.11, we particularly inflate the weight for the Costs and the Risks; however, in the second part, we inflate the weight for the Benefits and Opportunities while the overall ranking still favors the policy of assigning levies. Either when the cost and risk are weighted higher or when the benefits and opportunities are weighted higher, encouraging outflows are ranked second. In sum, we can safely conclude that the results in terms of preferred policy (i.e., assigning levies) are robust. Under normal circumstances, one needs to also conduct a sensitivity

analysis for each of the components discussed earlier. For example, one could evaluate whether the ranking of the sub-components in the benefits cluster will change if we alter the priority ranking of Liquidity and Chances. The same could have been done in the Opportunities, Costs, and Risk clusters. Since the majority of the inputs that we used in this AHP exercise are based on the quantitative results of the FCGE simulations, however, there is no additional value that one can gain from running additional sensitivity analyses. Looking at the experience in a number of emerging market economies, the economies are indeed seriously discussing the possibility of imposing some levy on capital flows. Some countries, such as South Korea, have already imposed levies on capital flows. Thus, the results of the AHP in this chapter provide some supporting arguments for what most emerging market economies are currently doing.

3.3.2. The ANP Model

Table 3.12. Overall Ranking using ANP through *Multiplicative* and *Additive* Synthesis

| ANP | Benefit b=0.25 | Opportunities o=0.25 | Costs c=0.25 | Risks r=0.25 | $(B*O)/(C*R)$ | $bB+oO-cC-rR$ | Ranking |
|----------------------|-------------------|-------------------------|-----------------|-----------------|---------------|---------------|----------|
| Aggressive Monetary | 0.438 | 0.477 | 0.724 | 0.487 | 0.593 | -0.074 | 3 |
| Assigning Levies | 0.436 | 0.340 | 0.066 | 0.155 | 14.626 | 0.139 | 1 |
| Encouraging Outflows | 0.126 | 0.182 | 0.210 | 0.359 | 0.305 | -0.065 | 2 |

Further advancing the analysis of AHP by incorporating the possible feedback affects, we apply the analytical network process to the same problem in order to determine whether the results of the AHP are consistent with those of the ANP. There

are many priority rankings that run contrary (opposite in direction) to the order we used in the hierarchical model to represent the feedback influence i.e., going upward from the alternative to the criteria, sub-criteria, and goals. As described in the methodology section, however, taking these feedback effects into account requires different a mathematical approach to come up with consistent rankings. In particular, one needs to generate a supermatrix where all goals, criteria, sub-criteria, and alternatives depend on themselves (or each other). For example, Table 3.7 shows resulting supermatrices of the Chances cluster under Benefits. Following Saaty (2001), taking the stochastic form of such matrix and multiplying it on itself exponentially will lead to an equilibrium that yields consistent rankings of the alternatives. Thus, by using such an approach, one can derive the priority rankings of the three policies. The results in Table 3.12 clearly show that the conclusion derived from AHP earlier remains unchanged – that is, assigning levies is the most preferred policy followed by encouraging outflows and adopting an aggressive monetary policy. When we alter the weight of the BOCR, the resulting ranking is also identical to those generated by the AHP model. Since the weights assigned in the feedback model are not necessarily based on the results of the FCGE simulation, however, a sensitivity analysis is warranted.

As shown in Figure 3.11 in Appendix IV, given the weight of the consumption spending (CD), the policy of assigning levies is most preferred, followed by the adoption of an aggressive monetary policy, assigning levies, and encouraging outflows. This ranking remains the same as we increase the weight of the CD up to slightly higher than 0.8; however, when we assign CD a weight higher than that, encouraging

outflows becomes more preferred than an aggressive monetary policy. In contrast, if the weight of the CD is drastically reduced to close to zero, then an aggressive monetary policy is most preferred.

When components other than CD are more significant, such as investment (ID), while the increased CFLOW will help to further stimulate the investment, the effectiveness of such stimulus pressure will be strengthened if the monetary authority also adopts a monetary policy, by lowering either the interest rate or the reserve requirement. Yet, in light of the broad range of weights for CD within which it is most preferred to assign levies, it is reasonable to suggest that the results in Figure 3.11 are robust. Similar to the sensitivity analysis for CD, if we raise the weight for investment (ID), the ranking of aggressive monetary policy tends to decline while that of assigning levies increases. In other words, even if we assign greater importance to the investment component, the strong preference for the policy, assigning levies, not only remains intact but becomes even more preferred. Consistent with the simulation results in Chapter 2, under the scenario of capital outflows, imposing levies would have yielded similar results as such a scenario under the outflows. Under such a scenario, banks' allocation of assets indicates an increase in bank loans, implying a higher level of investment. This is why Figure 3.11 shows that giving higher weight to investment results in giving greater weight to the assigning of levies. In the sensitivity analysis for FINTM imported and FIN INC, as shown in Figure 3.11, the dominance of assigning levies is clearly observed. Only when the weight of FINTM and FIN INC are raised to an extremely high level will aggressive monetary policy become dominant. Moving to the liquidity component in Figure 3.11 in Appendix IV clearly

shows that the highest priority is monetary policy. No matter what weight is assigned to either short-term security and equity or financial income, the superiority of aggressive monetary policy remains intact. These results yield an interesting conclusion with respect to the overall priority rankings for the three alternative policies – as can be seen in the earlier sensitivity analysis of the components of chances, assigning levies is superior while, from the perspective of liquidity, aggressive monetary policy is most preferred. In this kind of trade-off situation, one must rank the importance of the two components under the Benefits cluster, the results of which are shown in Table 3.13 where the weight of Liquidity is higher than that of Chances (0.65 vs. 0.35). Taking into account such a comparison, overall, there is a slightly higher preference for aggressive monetary policy than for assigning levies (0.438 vs. 0.436) as shown in Figure 3.12. The sensitivity analysis is largely similar for the Opportunities cluster in which the final ranking indicates that the aggressive monetary policy is considered capable of providing greater future benefits (opportunities) than assigning levies (0.477 vs. 0.340).

It is essential to note, however, the importance of priority ranking under the Cost and Risk clusters. Looking at Figure 3.13 in Appendix IV, given the weight of excess saving, an aggressive monetary policy would have been most costly since it could damage the competitiveness of the economy through an appreciated exchange rate. This result is robust irrespective of the weight assigned to excess saving. Similar results are observed for other sub-components under the competitiveness component in the Cost cluster, in which the aggressive monetary policy is considered to be most costly to the economy (see Figure 3.13 in Appendix IV). From the perspective of

income distribution, the results are even more robust – the finding that an aggressive monetary policy would be most costly to the economy is unchallenged no matter what weights are assigned to the different sub-components (see Figure 3.13 and Figure 3.14 in Appendix IV).

The robustness of the finding that aggressive monetary policy would be most costly is equally apparent when we examine long-term cost (risk) under the deflationary pressure component (Figure 3.14). Sensitivity analysis yielded slightly different results for the components of banks' vulnerability. Although aggressive monetary policy remains the most costly, if we inflate the weight or importance of CAR as one of the indicators affected by increased CFLOW, encouraging outflows eventually becomes more preferred than aggressive monetary policy. The inflection point occurs roughly at 0.6 (see Figure 3.14 in Appendix IV). In the case of a credit crunch component, the inflection point occurs at around 0.43, whereas for the wealth component it occurs at around 0.47. Looking at the broad range of the weights, however, it is reasonable to conclude that the sensitivity analysis of banks' vulnerability yields robust results in its finding that aggressive monetary policy is considered the costliest.

There are several sub-components under the volatility component in the Risk cluster. The sensitivity analysis shows that, with respect to different sub-components, the preferred policies are either aggressive monetary policy or encouraging outflows. None of the cases indicate that assigning levies is considered costly except when the weight of "bankF" is greatly inflated from the current rate 0.021 to above 0.6 (see Figure 3.14 in Appendix IV). Such a scenario, however, is highly unlikely. Taking the

overall comparisons into consideration (Figure 3.14 and Figure 3.15), the net outcome shows that, in the volatility component, the policy that is considered most costly is encouraging outflows. This is expected because the boom-and-bust episode from capital inflows to capital outflows indeed reflects the risk of volatility that may be damaging to the economy; however, since volatility is considered to be only the second most important risk, such a result may be offset by the dominance of an aggressive monetary policy as it is a most costly policy. Table 3.13 confirms that an aggressive monetary policy under the Risk cluster indeed remains the most costly. Encouraging outflows is ranked the second most costly.

Table 3.13. Overall Ranking for Each BOCR using ANP

| Benefits | Ideals | Normals | Raw | Ranking |
|----------------------|--------|---------|-------|----------|
| Aggressive Monetary | 1.000 | 0.438 | 0.859 | 1 |
| Assigning Levies | 0.995 | 0.436 | 0.854 | 2 |
| Encouraging Outflows | 0.288 | 0.126 | 0.247 | 3 |
| Opportunities | Ideals | Normals | Raw | Ranking |
| Aggressive Monetary | 1.000 | 0.477 | 0.826 | 1 |
| Assigning Levies | 0.713 | 0.340 | 0.589 | 2 |
| Encouraging Outflows | 0.382 | 0.182 | 0.316 | 3 |
| Costs | Ideals | Normals | Raw | Ranking |
| Aggressive Monetary | 1.000 | 0.724 | 1.000 | 1 |
| Assigning Levies | 0.091 | 0.066 | 0.091 | 3 |
| Encouraging Outflows | 0.290 | 0.210 | 0.290 | 2 |
| Risks | Ideals | Normals | Raw | Ranking |
| Aggressive Monetary | 1.000 | 0.487 | 0.981 | 1 |
| Assigning Levies | 0.318 | 0.155 | 0.312 | 3 |
| Encouraging Outflow | 0.737 | 0.359 | 0.723 | 2 |

Taking the four clusters together (i.e., BOCR), an interesting outcome emerges. While aggressive monetary policy is considered most beneficial as it can make the effect of increased CFLOW in stimulating economy more effective, it is also considered the most risky and costly as the economy can experience losing competitiveness and worsening income distribution. As shown in Table 3.13, that policy is ranked the highest from the perspective of benefits and opportunities, but at the same time it is also ranked highest as the most costly and risky. On the other hand, from the perspective of benefits and opportunities, assigning levies is the second most preferred policy, but at the same time, it is considered the least costly and risky. Thus, assigning levies is expected to be the ultimate ‘winner’. Table 3.12 confirms this expectation. Whether one uses the *multiplicative* or *additive* approach of BOCR, assigning levies is considered the most preferred policy for responding to increased CFLOW.

Table 3.14. Overall ranking using ANP through *mutiplicative* and *additive* synthesis under different weights on BOCR

| AHP | Benefit b=0.25 | Opportunities o=0.1 | Costs c=0.35 | Risks r=0.3 | $(B*O)/(C*R)$ | $bB+oO-cC-rR$ | Ranking |
|----------------------|-------------------|------------------------|-----------------|----------------|---------------|---------------|----------|
| Aggressive Monetary | 0.438 | 0.477 | 0.724 | 0.487 | 0.593 | -0.242 | 3 |
| Assigning Levies | 0.436 | 0.340 | 0.066 | 0.155 | 14.626 | 0.074 | 1 |
| Encouraging Outflows | 0.126 | 0.182 | 0.210 | 0.359 | 0.305 | -0.131 | 2 |

| AHP | Benefit b=0.35 | Opportunities o=0.3 | Costs c=0.25 | Risks r=0.1 | $(B*O)/(C*R)$ | $bB+oO-cC-rR$ | Ranking |
|----------------------|-------------------|------------------------|-----------------|----------------|---------------|---------------|----------|
| Aggressive Monetary | 0.438 | 0.477 | 0.724 | 0.487 | 0.593 | 0.0668 | 2 |
| Assigning Levies | 0.436 | 0.340 | 0.066 | 0.155 | 14.626 | 0.2227 | 1 |
| Encouraging Outflows | 0.126 | 0.182 | 0.210 | 0.359 | 0.305 | 0.0105 | 3 |

In some cases, one would wish to give a different weight to each BOCR. For example, those with optimistic inclinations may wish to assign higher weights to the Benefits and Opportunities, while those with more pessimistic inclinations may wish to assign higher weights to Cost and Risk. In this context, we tried to examine the problem by comparing the results representing those two possibilities. When Costs and Risks are given higher weights, the rankings in the first part of the table remain the same. That is, assigning levies is still most preferred, while encouraging outflows and aggressive monetary policies are second and third, respectively. When the weights for Benefits and Opportunities are inflated, as in the second part of Table 3.14, assigning levies is again the preferred measure regardless of the approach taken (whether additive or multiplicative), although the second and third ranks change when the additive approach is used. In particular, under the multiplicative approach, encouraging outflows is ranked second, and aggressive monetary policies third; however, under the additive approach, aggressive monetary policies ranks second, and encouraging outflows third. To clarify further, each of the four factors of BOCR is weighted differently to generate a chart in the Appendix (i.e., sensitivity analysis for BOCR). It is clear that the dominance of the aggressive monetary policies in the benefits and opportunities remains intact regardless of the weights assigned to the Benefits and Opportunities clusters, and the same policy is considered the costliest and riskiest regardless of the weights assigned to the cost and risk. In sum, the results shown in Tables 3.12 and 3.14 are robust.

It is important to re-emphasize here that this result takes into account the macro, financial, and social issues simultaneously as they are represented in the

networks under each of the clusters, as shown in Figure 3.5. For example, macro issues are captured through variables such as ID, CD, PINDEX, and RER, while financial issues are reflected in variables such as short-term security, equity, RN, and CAR. Social issues include household income originating from the financial sector (e.g., short-term security income and equity income) and from factor incomes (e.g., wages), as well as unemployment and poverty line, income distribution between poor and rich and between rural and urban areas.

3.4. Concluding Remarks

The complexity of the economy as elaborated in Chapters 1 and 2 is analyzed through the use of CGE and FCGE models. Using such models, we have run a scenario where the ultra-easy monetary policy in an advanced economy following the global financial crisis has raised massive capital flows to emerging market economies. Focusing on bank-led flows (i.e., flows intermediated by the banking sector), the analysis in chapter 2 reveals that increased bank-led flows can produce some risks as well as potential benefits. In this chapter, we went further by exploring the question of what policy response that would be most appropriate in such circumstances. In addition, to incorporate some elements of reality, we classified the overall strategic goals into macro issues, financial issues and social issues. While increased bank-led flows may provide benefits (B) in the short run and potential benefits in the future (opportunities, O), they may also create some short-run costs (C) as well as potential costs (risk, R). All of these BOCR are taken together and linked with three policy

measures: aggressive monetary policy, assigning levies, and encouraging outflows. To generate consistent priority rankings of those policies, while at the same time capturing the dynamics and the feedback effects of the system, including some intangible factors, we used the analytic network process (ANP) and analytic hierarchy process (AHP). Unlike AHP, the ANP explicitly takes into account the feedback effects. Most of the inputs we used are derived from the pairwise comparison and taken from quantitative numbers derived from the model simulations in Chapter 2. In cases where the relations are non-existent, or the implied coefficients are either not measured by the model or intangibles in nature, inputs are made based on informed perceptions. The overall conclusion points to the superiority of assigning levies on bank-led flows. The preference for this policy passes several sensitivity tests, implying that the result is robust.

Indeed, the primary function of a bank is to intermediate customers' funds such as saving deposits (the core liabilities of banks) by allocating those funds to some uses through loans. That is, bank's role is to conduct financial resource allocation such that savers gain benefits from the interest rates, while the economy grows from the loan-funded investment. This is the essence of bank's intermediation function. With the increased bank-led flows (banks' non-core liabilities), that function is somehow disrupted, where most financial resources are used by banks to invest in risky financial assets rather than for loans that can help stimulate the economy. It is therefore important to propose policies that can mitigate such a possibility. Assigning levies to banks' non-core liabilities is intended for precisely that purpose. Some emerging market economies have either already implemented or seriously considered

implementing this policy. This is part of what is known as macro-prudential policy.

This chapter's analysis not only provides support for such a policy but can also help policymakers to explore alternative policies given the prevailing conditions. This is important because different countries have different situations and sensitivities towards each of the issues (i.e., macro, financial, and social).

When time and resources permit, one can conduct the analysis by using the approach and model in this chapter through direct interviewing. The respondents can be selected experts or policymakers who can express their perceptions regarding the relations among variables in the model. In this way, the resulting priority ranking from the model simulation can be compared with, or tested against, policymakers' perceptions, from which new insights may emerge.

APPENDICES

Appendix I: Fundamental Scale of Absolute Numbers

| <i>Intensity of Importance</i> | <i>Definition</i> | <i>Explanation</i> |
|--------------------------------|---|---|
| 1 | Equal importance | Two activities contribute equally to the objective. |
| 2 | Weak or slight | |
| 3 | Moderate importance | Experience and judgment slightly favor one activity over another. |
| 4 | Moderate plus | |
| 5 | Strong importance | Experience and judgment strongly favor one activity over another. |
| 6 | Strong plus | |
| 7 | Very strong or demonstrated importance | An activity is favored very strongly over another; its dominance is demonstrated in practice. |
| 8 | Very, very strong | |
| 9 | Extreme importance | The evidence favoring one activity over another is of the highest possible order of affirmation. |
| 1.1-1.9 | When activities are very close, a decimal is added to 1 to show their difference as appropriate. | A better alternative to assigning the small decimals is to compare two close activities with other widely contrasting ones, favoring the larger one a little more than the smaller one when using the values 1-9. |
| Reciprocals of above | If activity i has one of the above non-zero numbers assigned to it when compared with activity j , then j has the reciprocal value when compared with i . | A logical assumption |
| Measurements from ratio scales | | When it is desired to use such numbers in physical applications. Alternatively, one often estimates the ratios of such magnitudes by using one's judgment. |

Appendix II: Data Input Methods To Acquire Relative Intensities in AHP and ANP Models using Super Decision Software

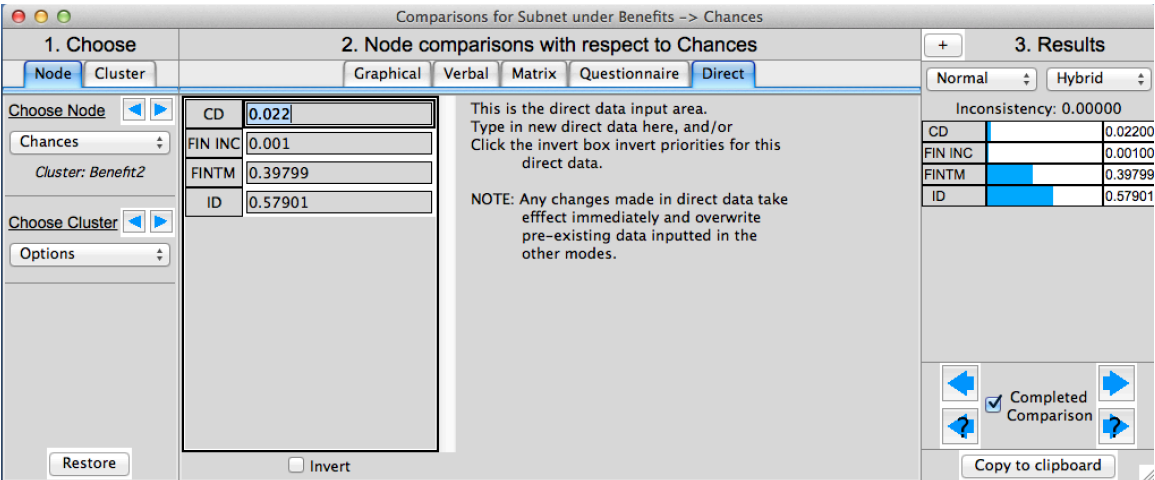


Figure 3.8. Direct Data Input Method

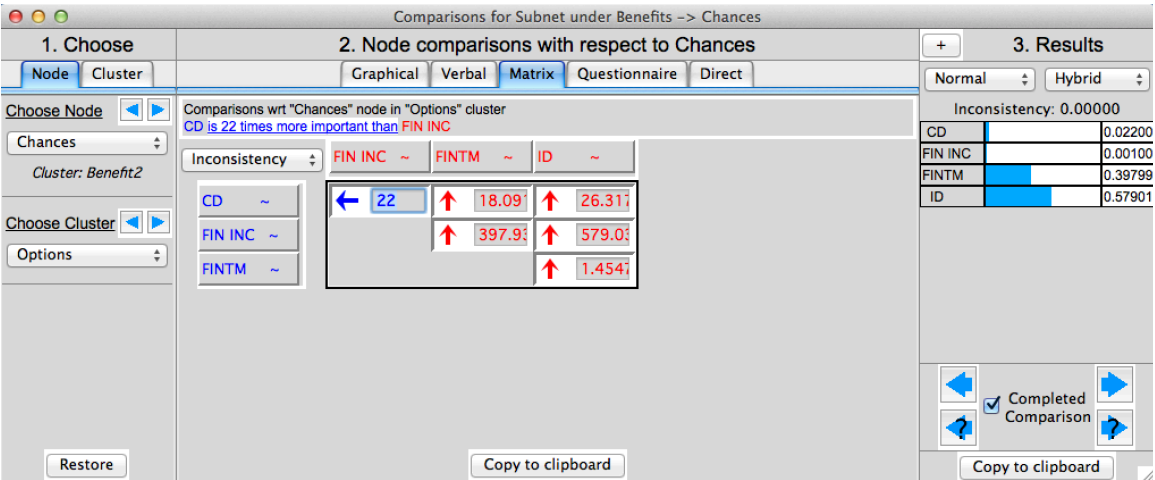


Figure 3.9. Matrix Method

Comparisons for Subnet under Benefits --> Chances

1. Choose

Node
Cluster

Choose Node

1Aggressive Mo~

Cluster: Alternatives

Choose Cluster

Options

Restore

2. Node comparisons with respect to 1Aggressive Monetary

Graphical
Verbal
Matrix
Questionnaire
Direct

Comparisons wrt "1Aggressive Monetary" node in "Options" cluster
FIN INC is moderately more important than CD

| | | | | | | | | | | | | | | | | | | | | | |
|----|---------|-------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|-------|----------|---------|
| 1. | CD | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | FIN INC |
| 2. | CD | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | FINTM |
| 3. | CD | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | ID |
| 4. | FIN INC | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | FINTM |
| 5. | FIN INC | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | ID |
| 6. | FINTM | >=9,5 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | >=9,5 | No comp. | ID |

3. Results

Normal
Hybrid

Inconsistency: 0.00000

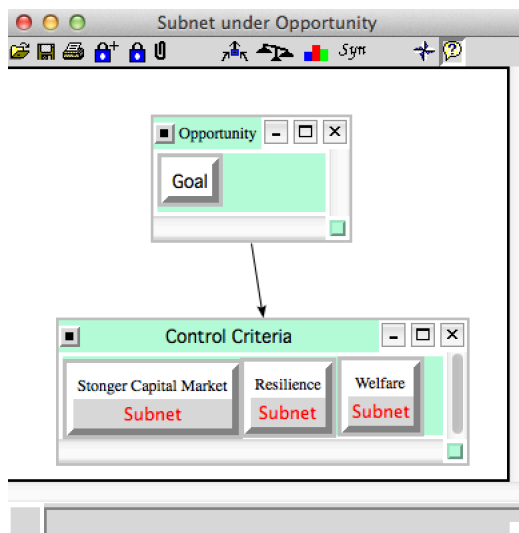
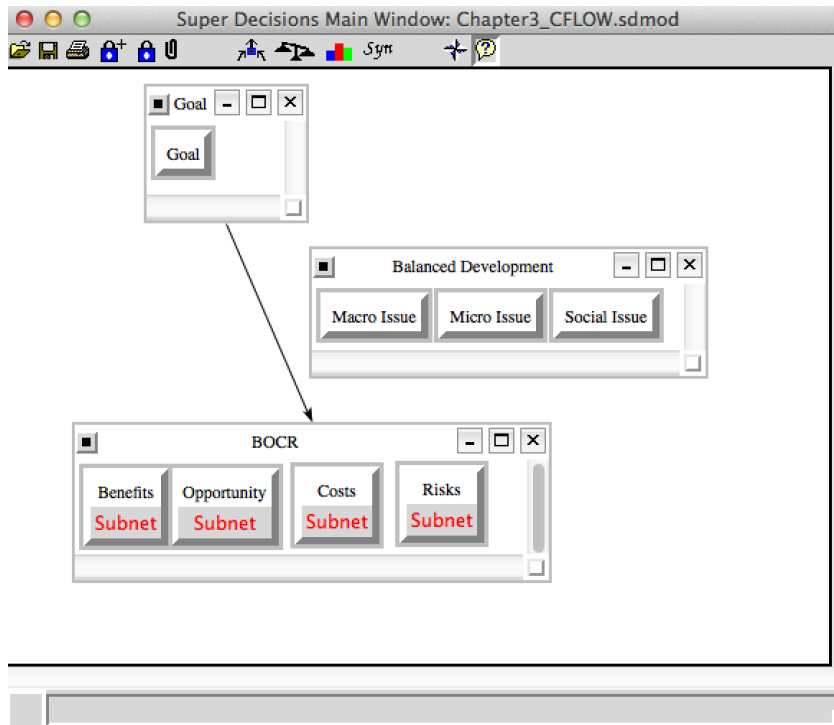
| | | |
|---------|--|---------|
| CD | | 0.13000 |
| FIN INC | | 0.35000 |
| FINTM | | 0.25000 |
| ID | | 0.27000 |

Completed Comparison

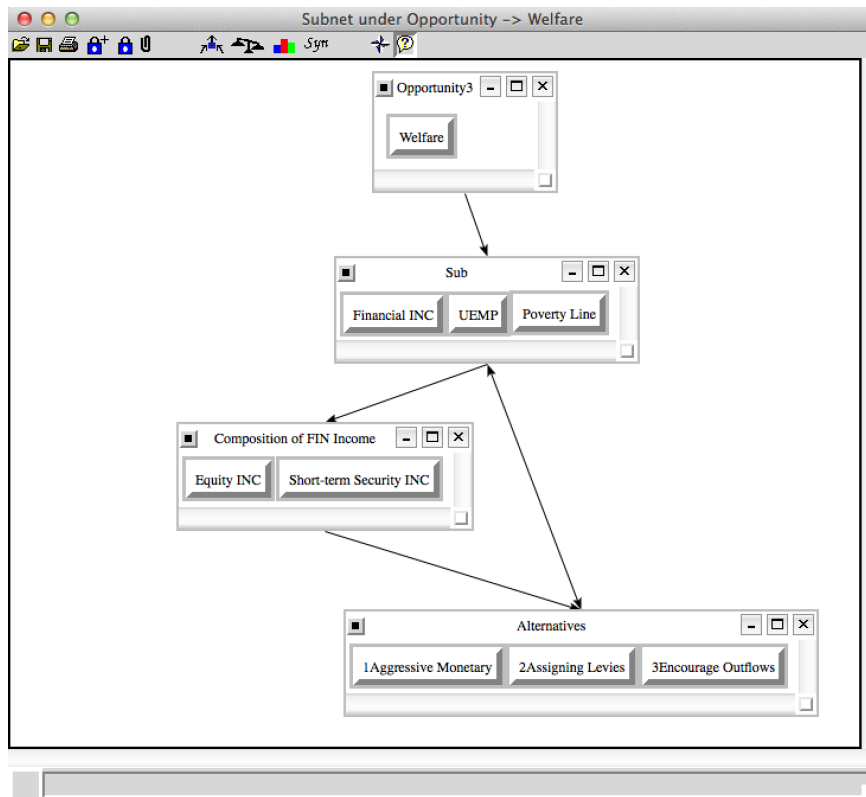
Copy to clipboard

Figure 3.10. Questionnaire –Pairwise Comparison -- Method

Appendix III: Analytical Network Process In Super Decision Software



Sub-network For “Opportunities”



Sub-Sub-network For “Welfare” Under “Opportunities”

Appendix IV: Sensitivity Analysis Graphs for Each Variable under BOCR in ANP

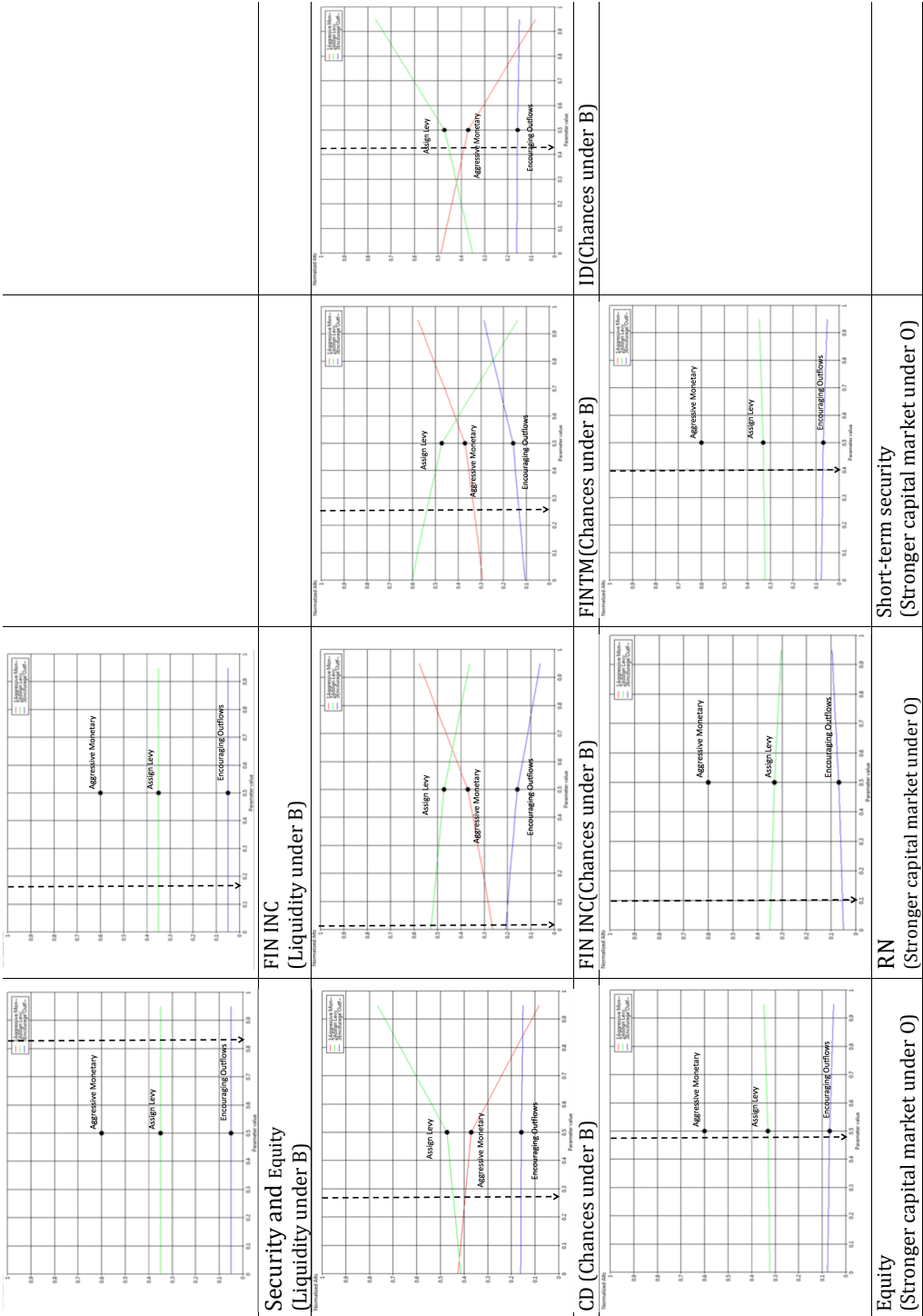


Figure 3.11. Sensitivity Analysis for Each Variable under Benefits and Opportunities (1)

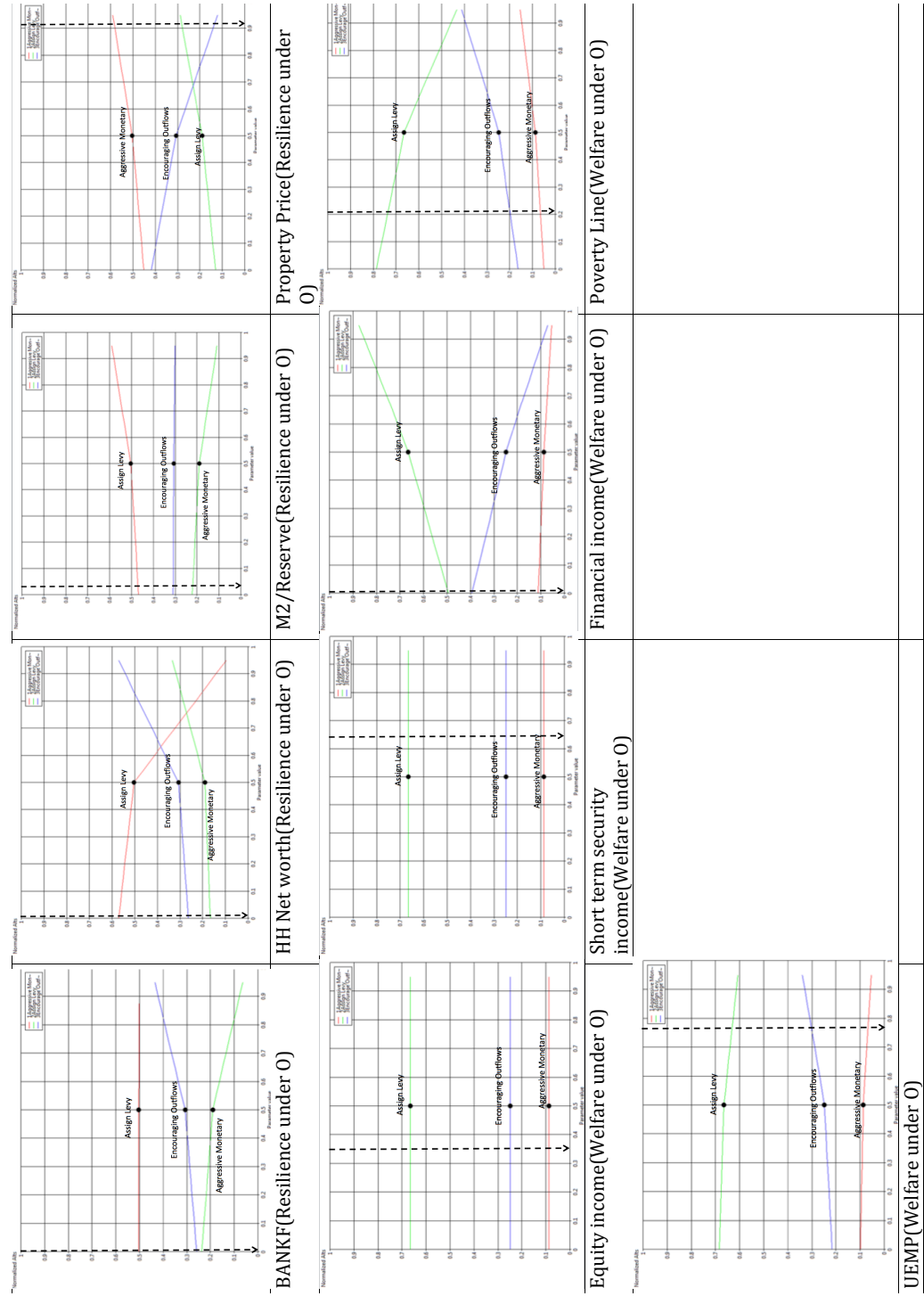


Figure 3.12. Sensitivity Analysis for Each Variable under Benefits and Opportunities (2)

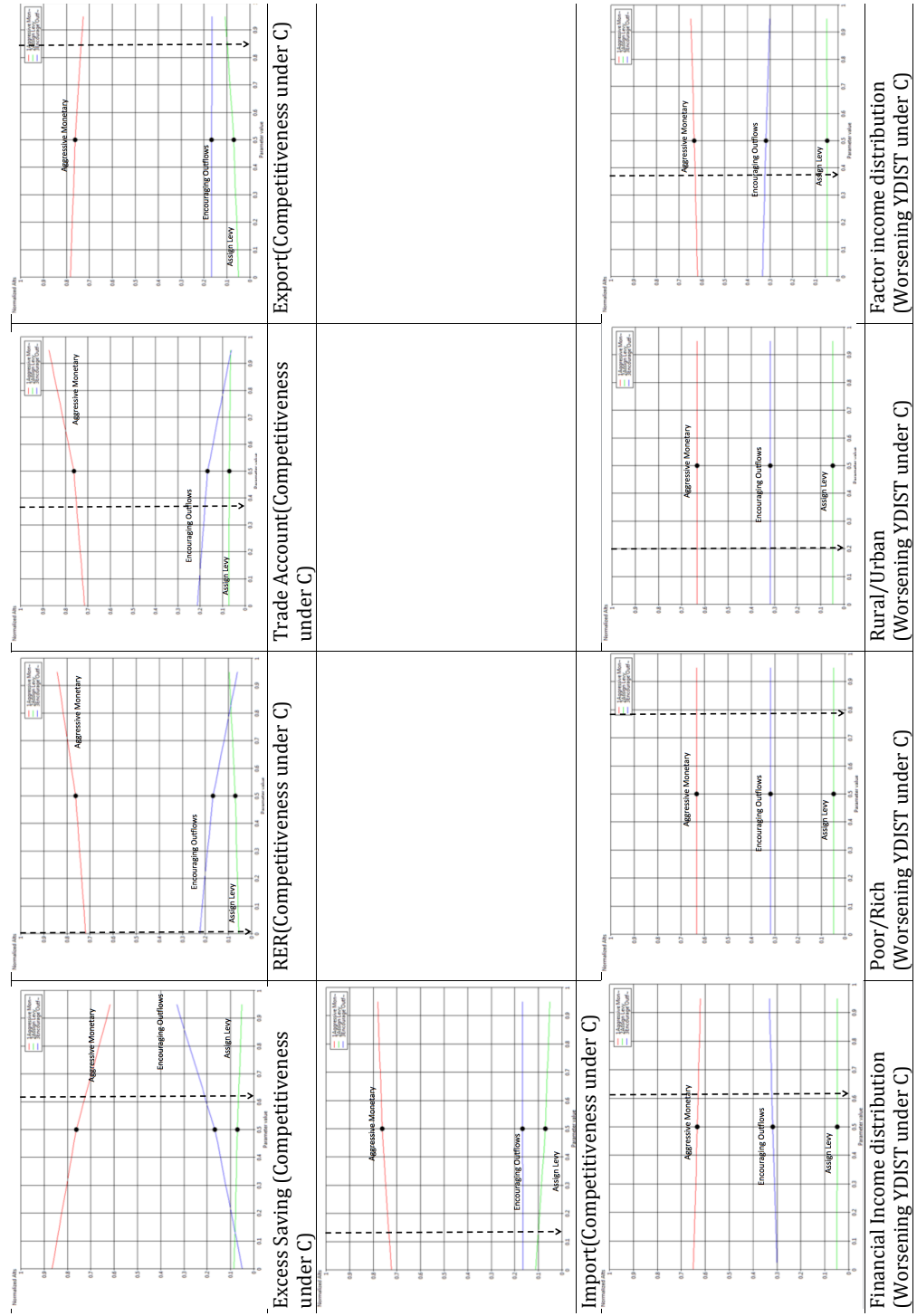


Figure 3.13. Sensitivity Analysis for Each Variable under Costs and Risks

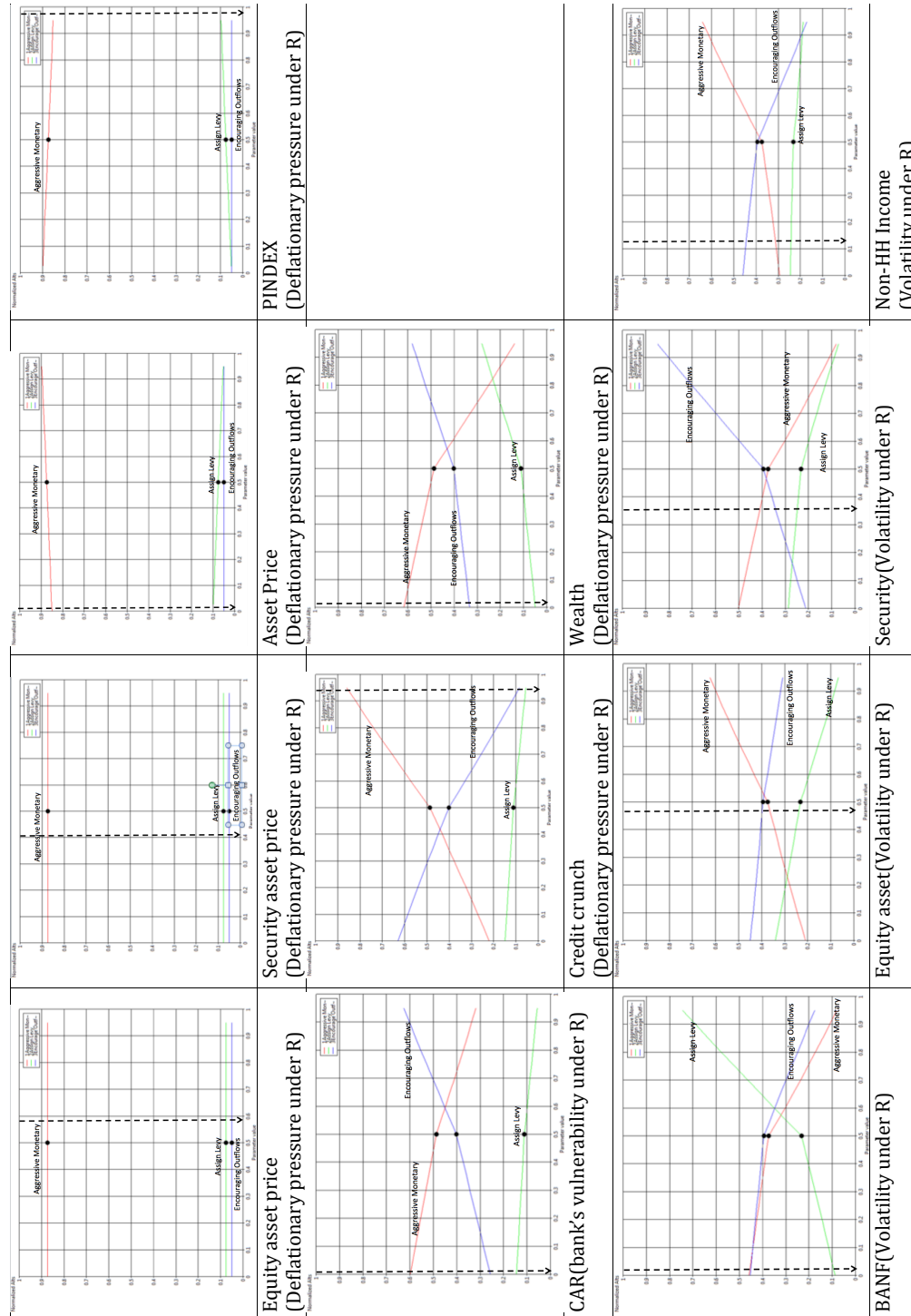


Figure 3.14. Sensitivity Analysis for Each Variable under Risks (1)

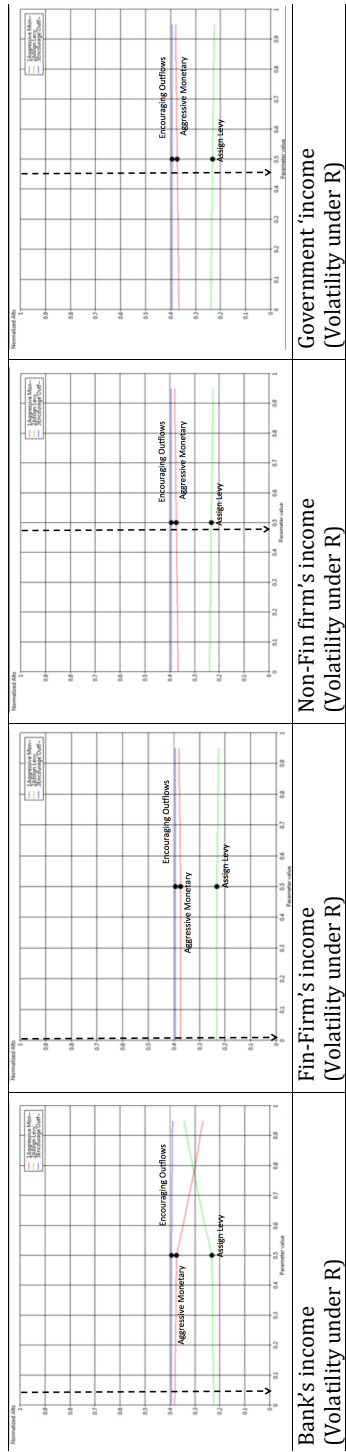


Figure 3.15. Sensitivity Analysis for Each Variable under Risks (2)

BIBLIOGRAPHY

Azis, I., 2010: “Predicting a Recovery Date from the Economic Crisis of 2008”, *Socio-Economic Planning Sciences*, Vol. 44, pp. 122-129

Azis, I.J., 2009: *Crisis, Complexity, and Conflict*, Emerald Group Publishing Limited, Bingley, England

Azis, I. J., 2012: “Entering the Uncharted Territory”, *The Research Institute of Economy, Trade and Industry (RIETI)*.

Azis, I. J., 2012: “Asian Regional Financial Safety Nets? Don’t Hold Your Breath”, *Policy Research Institute, Ministry of Finance, Japan, Public Policy Review*, Vol.8, No3, August, pp. 321- 340

Azis, I. J., 2012: “Macro Prudential Policy in the Midst of Capital Inflows: A Simple Model of Banks’ Vulnerability”, December

Brunnermeier, M. K. et al (Committee on International Economic Policy and Reform), 2012, “Banks and Cross-Border Capital Flows: Policy Challenges and Regulatory Responses”, Sep

Ostry, J.D. et al, 2010: “Capital Inflows: The Role of Controls”, *IMF Staff Position Note*, Feb.

Shin, H.S., and Shin, K., 2010: “Bank Regulation and Capital Inflows: An Emerging Market Perspective”, Presented at ‘Reshaping Global Economic Governance and the Role of Asia in G20’ ADB/Peterson Institute Conference, Washington DC, April 20th

Saaty, T., 2005: *Theory and Applications of the Analytical Network Process*,

RWS Publications, Pittsburg, USA

Saaty, T., 2001: “Decision Making with Dependence and Feedback: The Analytic Network Process”, RWS Publications, Pittsburg, USA

Saaty, T., and Peniwati, K., 2008 : “Group Decision Making: Drawaing out and Reconciling Differences”, RWS Publications, Pittsburg, USA

Saaty, T., and Cillo, B., 2008: “The Encyclicon Vol 2: A Dictionary of Complex Decisions Using the Analytic Network Process”, RWS Publications, Pittsburg, USA

Saaty, T., 2001: “Theory and Applications of the Analytic Network Process: Decision Making with Benefits, Opportunities, Costs, and Risks”, RWS Publications, Pittsburg, USA

Tong, H., and Wei, S., 2009: “ The Composition Matters: Capital Inflows and Liquidity Crunch During A Global Economic Crisis”, NBER Working Paper Series 15207.